ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 87

[AMS-FRL-7561-7]

RIN 2060-AK01

Control of Air Pollution From Aircraft and Aircraft Engines; Emission Standards and Test Procedures

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: In this action, we are proposing to amend the existing United States regulations governing the exhaust emissions from new commercial aircraft gas turbine engines. Under the authority of section 231 of the Clean Air Act (CAA), the Environmental Protection Agency (EPA) is proposing new emission standards for oxides of nitrogen (NO_x) for newly certified commercial aircraft gas turbine engines with rated thrust greater than 26.7 kilonewtons (kN). This action proposes to adopt standards equivalent to the latest (effective in 2004) NO_x standards of the United Nations International Civil Aviation Organization (ICAO), and thereby bring the United States emission standards into alignment with the internationally adopted standards. In

addition, today's action also would amend the test procedures for gaseous exhaust emissions to correspond to recent amendments to the ICAO test procedures for these emissions.

After December 31, 2003, the proposed NO_x standards would apply to newly certified gas turbine engines – those engines designed and certified after the effective date of the proposed regulations (for purposes of this action, the date of manufacture of the first individual production model means the date of type certification). Since the proposed NO_x standards would apply to only newly certified gas turbine engines, newly manufactured engines (those engines built after the effective date of the proposed regulations) would not have to meet these standards. Moreover, all engines currently being built would not have to comply with the NO_x emission standards that EPA is adopting today.

Today's proposed amendments to the emission test procedures are those recommended by ICAO and are widely used by the aircraft engine industry. Thus, today's action would establish consistency between U.S. and international standards, requirements, and test procedures. Since aircraft and aircraft engines are international commodities, there is significant commercial benefit to consistency between U.S. and international emission standards and control program requirements. In addition, today's action ensures that domestic commercial aircraft would meet the current international standards, and thus, the public can be assured they are receiving the air quality benefits of the international standards.

DATES: Comments: EPA requests comments on the proposed rulemaking by December 15, 2003. More information about commenting on this action may be found under Public Participation in the **SUPPLEMENTARY INFORMATION** section and section I.C.

Hearing: We will hold a public hearing on November 13, 2003 at the Environmental Protection Agency, EPA East Building, Room Number 1153, 1201 Constitution Avenue, N.W., Washington, DC 20004, Telephone: (202) 564-1682. The hearing will start at **10:00 a.m.** local time and continue until everyone has had a chance to speak. If you want to testify at the hearing, notify the contact person listed below at least ten days before the hearing. See section VIII for more information about public hearings.

ADDRESSES: Comments may be submitted electronically, by mail, by facsimile, or through hand delivery/courier. Follow the detailed instructions as provided in section I.C. of the **SUPPLEMENTARY INFORMATION** section.

FOR FURTHER INFORMATION CONTACT: Mr. Bryan Manning, U.S. EPA, Office of Transportation and Air Quality, Assessment and Standards Division, 2000 Traverwood, Ann Arbor, MI 48105. Telephone (734) 214-4832; Fax: (734)214-4816, E-mail: manning.bryan@epa.gov.

SUPPLEMENTARY INFORMATION:

Outline of This Preamble

2. Particulate Matter

a. Health Effects of $PM_{2.5}$

b. Current and Projected Levels

B. Other Environmental Effects

1. Acid Deposition

2. Eutrophication and Nitrification

3. Plant Damage from Ozone

4. Visibility

C. Other Criteria Pollutants Affected by This Proposed Rule

IV. Description of Action

A. What Emission Standards Are Under Consideration?

1. Today's Proposed NO_x Standards

a. For Engines With a Pressure Ratio of 30 or less

i. For engines with a maximum rated output of more than 89.0 kN

ii. For engines with a maximum rated output of more than 26.7 kN but not more than 89.0 kN

b. For Engines With A Pressure Ratio of More Than 30 But Less than 62.5

i. For engines with a maximum rated output of more than 89.0 kN

ii. For engines with a maximum rated output of more than 26.7 kN but not more than 89.0 kN

c. For Engines With a Pressure Ratio of 62.5 or More

2. Proposed NO_x Standards of Newly Certified Mid-and High-Thrust Engines

I. General Information

A. Regulated Entities

Entities potentially regulated by this action are those that manufacture and sell commercial aircraft engines and aircraft in the United States, and the owners/operators of such aircraft (and accompanying engines) in the United States. Regulated categories include:

Category	NAICS[a] Codes	SIC Codes[b]	Examples of potentially affected entities

Industry	336412	3724	Manufacturers of new aircraft engines
Industry	336411	3721	Manufacturers of new aircraft
Industry	481	4512	Scheduled air carriers, passenger and freight

[a] North American Industry Classification System (NAICS)

[b] Standard Industrial Classification (SIC) system code

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that EPA is now aware could potentially be regulated by this action. Other types of entities not listed in the table could also be regulated. To determine whether your activities are regulated by this action, you should carefully examine the applicability criteria in 40 CFR 87.20. If you have any questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

B. How Can I Get Copies Of This Document and Other Related Information ?

1. *Docket.* EPA has established an official public docket for this action under Docket ID No. **OAR 2002-0030.** The official public docket is the collection of materials that is available for public viewing at the Air Docket in the EPA Docket Center, (EPA/DC) EPA West, Room B102, 1301 Constitution Ave., NW, Washington, DC. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays.

The telephone number for the Reading Room and the Air Docket is (202) 566-1742. You may be charged a reasonable fee for photocopying docket materials, as provided in 40 CFR part 2.

2. *Electronic Access.* You may access this Federal Register document electronically through the EPA Internet under the "Federal Register" listings at *http://www.epa.gov/fedrgstr/*.

An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may use EPA Dockets at http://www.epa.gov/edocket/ to submit or view public comments, access the index listing of the contents of the official public docket, and to access those documents in the public docket that are available electronically. Once in the system, select "search," then key in the appropriate docket identification number.

Certain types of information will not be placed in the EPA Dockets. Information claimed as confidential business information (CBI) and other information whose disclosure is restricted by statute, which is not included in the official public docket, will not be available for public viewing in EPA's electronic public docket. EPA's policy is that copyrighted material will not be placed in EPA's electronic public docket but will be available only in printed, paper form in the official public docket. To the extent feasible, publicly available docket materials will be made available in EPA's electronic public docket. When a document is selected from the index list in EPA Dockets, the system will identify whether the document is available for viewing in EPA's electronic public docket. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the docket facility identified in section I.B.1. EPA intends to work towards providing electronic access to all of the publicly available docket materials through EPA's electronic public docket.

For public commenters, it is important to note that EPA's policy is that public comments, whether submitted electronically or in paper, will be made available for public viewing in EPA's electronic public docket as EPA receives them and without change, unless the comment contains copyrighted material, CBI, or other information whose disclosure is restricted by statute. When EPA identifies a comment containing copyrighted material, EPA will provide a reference to that material in the version of the comment that is placed in EPA's electronic public docket. The entire printed comment, including the copyrighted material, will be available in the public docket.

Public comments submitted on computer disks that are mailed or delivered to the docket will be transferred to EPA's electronic public docket. Public comments that are mailed or delivered to the Docket will be scanned and placed in EPA's electronic public docket. Where practical, physical objects will be photographed, and the photograph will be placed in EPA's electronic public docket along with a brief description written by the docket staff.

For additional information about EPA's electronic public docket visit EPA Dockets online or see 67 FR 38102, May 31, 2002.

C. How and To Whom Do I Submit Comments?

You may submit comments electronically, by mail, by facsimile, or through hand delivery/courier. To ensure proper receipt by EPA, identify the appropriate docket identification number in the subject line on the first page of your comment. Please ensure that your comments are submitted within the specified comment period. Comments received after the close of the comment period will be marked "late." EPA is not required to consider these late comments.

1. *Electronically*. If you submit an electronic comment as prescribed below, EPA recommends that you include your name, mailing address, and an e-mail address or other contact information in the body of your comment. Also include this contact information on the outside of any disk or CD ROM you submit, and in any cover letter accompanying the disk or CD ROM. This ensures that you can be identified as the submitter of the comment and allows EPA to contact you in case EPA cannot read your comment due to technical difficulties or needs further information on the substance of your comment. EPA's policy is that EPA will not edit your comment, and any identifying or contact information provided in the body of a comment will be included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment.

a. *EPA Dockets*. Your use of EPA's electronic public docket to submit comments to EPA electronically is EPA's preferred method for receiving comments. Go directly to EPA Dockets at http://www.epa.gov/edocket, and follow the online instructions for submitting comments. To access EPA's electronic public docket from the EPA Internet Home Page, select "Information Sources," "Dockets," and "EPA Dockets." Once in the system, select "search," and then key in Docket ID No. **OAR 2002-0030**. The system is an "anonymous access" system, which means EPA will not know your identity, e-mail address, or other contact information unless you provide it in the body of your comment.

b. *E-mail*. Comments may be sent by electronic mail (e-mail) to aircraft@epa.gov, Attention Docket ID No. **OAR 2002-0030**. In contrast to EPA's electronic public docket, EPA's e-mail system is not an "anonymous access" system. If you send an e-mail comment directly to the Docket without going through EPA's electronic public docket, EPA's e-mail system automatically captures your e-mail address. E-mail addresses that are automatically captured by EPA's e-mail system are included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket.

c. *Disk or CD ROM*. You may submit comments on a disk or CD ROM that you mail to the mailing address identified in section I.C.2. These electronic submissions will be accepted in WordPerfect or ASCII file format. Avoid the use of special characters and any form of encryption.

2. *By Mail*. Send your comments to: Air Docket, Environmental Protection Agency, Mailcode: 6102T, 1200 Pennsylvania Ave., NW, Washington, DC, 20460, Attention Docket ID No. **OAR 2002-0030**.

3. *By Hand Delivery or Courier*. Deliver your comments to: EPA Docket Center, (EPA/DC) EPA West, Room B102, 1301 Constitution Ave., NW, Washington, DC. 20004, Attention Docket ID No. **OAR 2002-0030**. Such deliveries are only accepted during the

Docket's normal hours of operation as identified in section I.B.1.

4. *By Facsimile.* Fax your comments to: (202) 566-1741, Attention Docket ID. No. OAR 2002-0030.

D. How Should I Submit CBI To the Agency?

Do not submit information that you consider to be CBI electronically through EPA's electronic public docket or by e-mail. Send or deliver information identified as CBI only to the contact person listed in the **FOR FURTHER INFORMATION CONTACT** section. You may claim information that you submit to EPA as CBI by marking any part or all of that information as CBI (if you submit CBI on disk or CD ROM, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is CBI). Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

In addition to one complete version of the comment that includes any information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket and EPA's electronic public docket. If you submit the copy that does not contain CBI on disk or CD ROM, mark the outside of the disk or CD ROM clearly that it does not contain CBI. Information not marked as CBI will be included in the public docket and EPA's electronic public docket without prior notice. If you have any questions about CBI or the procedures for claiming CBI, please consult the person identified in the **FOR FURTHER INFORMATION CONTACT** section.

E. What Should I Consider as I Prepare My Comments for EPA?

You may find the following suggestions helpful for preparing your comments:

1. Explain your views as clearly as possible.

2. Describe any assumptions that you used.

3. Provide any technical information and/or data you used that support your views.

4. If you estimate potential burden or costs, explain how you arrived at your estimate.

5. Provide specific examples to illustrate your concerns.

6. Offer alternatives.

7. Make sure to submit your comments by the comment period deadline identified.

8. To ensure proper receipt by EPA, identify the appropriate docket identification number in the subject line on the first page of your response. It would also be helpful if you provided the name, date, and **Federal Register** citation related to your comments.

II. Introduction

A. Brief History of EPA's Regulation of Aircraft Engine Emissions

Section 231(a)(2)(A) of the Clean Air Act (CAA) directs the EPA Administrator to "issue proposed emission standards applicable to the emission of any air pollutant from any class or classes of aircraft or aircraft engines which in his judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare" (42 U.S.C. 7571(a)(2)(A)). Under this authority EPA has conducted several rulemakings since 1973 establishing emission standards and related requirements for several classes (commercial and general aviation engines) of aircraft and aircraft engines. Most recently, in 1997 EPA promulgated NO_x emission standards for newly manufactured gas turbine engines (those engines built after the effective date of the regulations or already certified engines) and for newly certified gas turbine engines (those engines designed and certified after the effective date of the regulations[1]).[2] In addition, EPA promulgated a carbon monoxide (CO) emission standard for newly manufactured gas turbine engines in this same 1997 rulemaking. At the time, the 1997 rulemaking established consistency between the U.S. and international standards. (See 40 CFR part 87 for a description of EPA's aircraft engine emission control requirements and 14 CFR part 34 for the Secretary of Transportation's regulations for ensuring compliance with these standards in accordance with section 232 of the Clean Air Act.)

B. Interaction With the International Community

Since publication of the initial standards in 1973, EPA, together with the Federal Aviation Administration (FAA), has worked with the International Civil Aviation Organization

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[1]Throughout this notice, the date of manufacture of the first individual production model means the date of type certification.

[2]U.S. EPA, “Control of Air Pollution from Aircraft and Aircraft Engines; Emission Standards and Test Procedures;” Final Rule, 62 FR 25356, May 8, 1997.

(ICAO) on the development of international aircraft engine emission standards. ICAO was established in 1944 by the United Nations (by the Convention on International Civil Aviation, the "Chicago Convention") "... in order that international civil aviation may be developed in a safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically."[3] ICAO's responsibilities include developing aircraft technical and operating standards, recommending practices, and generally fostering the growth of international civil aviation.

In 1972 at the United Nations Conference on the Human Environment, ICAO's position on the human environment was developed to be the following: "[i]n fulfilling this role ICAO is conscious of the adverse environmental impact that may be related to aircraft activity and its responsibility and that of its member States to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of the human environment." Also, in 1972 ICAO established the position to continue "* * * with the assistance and cooperation of other bodies of the Organization and other international organizations * * * the work related to the development of Standards, Recommended Practices and Procedures and/or guidance material dealing with the quality of the human environment * * *."[4]

[3]ICAO, "Convention on International Civil Aviation," Sixth Edition, Document 7300/6, 1980. Copies of this document can be obtained from the ICAO website located at www.icao.int.

[4]International Civil Aviation Organization (ICAO), Foreword of "Aircraft Engine Emissions," International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Second Edition, July 1993. Copies of this document can be obtained from the ICAO website located at www.icao.int.

The United States is one of 188 participating member States of ICAO.[5] Under the basic ICAO treaty established in 1944 (the Chicago Convention), a participating nation which elects not to adopt the ICAO standards must provide a written explanation to ICAO describing why a given standard is impractical to comply with or not in their national interest.[6] ICAO has no punitive powers for states that elect not to adopt ICAO standards. ICAO standards require States to provide written notification and failure to provide such notification could have negative consequences as detailed below.

If a Contracting State files a written notification indicating that it does not meet ICAO standards, other Contracting States are absolved of their obligations to "recognize as valid" the certificate of airworthiness issued by that Contracting States, since that certificate will not have been issued under standards "equal to or above" ICAO standards. In other words, other Contracting States do not have to allow aircraft belonging to that Contracting State to travel through their airspace.[7] Further, if it fails to file a written notification, it will be in default of its

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[5]As of June 20, 2002 there were 188 Contracting States according to the ICAO website located at www.icao.int.

[6]*Text of Article 38 of Chicago Convention:*
Any State which finds it impracticable to comply in all respects with any such international standard or procedure, or to bring its own regulations or practices into full accord with any international standard or procedure after amendment of the latter, or which deems it necessary to adopt regulations or practices differing in any particular respect from those established by an international standard, shall give immediate notification to the International Civil Aviation Organization of the differences between its own practice and that established by the international standard . . . . In any such case, the Council shall make immediate notification to all other states of the difference which exists between one or more features of an international standard and the corresponding national practice of that State.

[7]*Text of Article 33 of Chicago Convention:*
Certificates of airworthiness and certificates of competency and licenses issued or rendered valid by the contracting State in which the aircraft is registered, shall be recognized as valid by the

obligations, and risks mandatory exclusion of its aircraft from the airspace of other Contracting States and the loss of its voting power in the Assembly and Council.[8]

The ICAO Council's Committee on Aviation Environmental Protection (CAEP) undertakes ICAO's technical work in the environmental field. The CAEP is responsible for evaluating, researching, and recommending measures to the ICAO Council that address the environmental impact of international civil aviation. CAEP is composed of various Study Groups, Work Groups, Committees and other contributing memberships that include atmospheric, economic, aviation, environmental, and other professionals committed to ICAO's previously stated position regarding aviation and the environment. At CAEP meetings, the United States is represented by the FAA, which plays an active role at these meetings (see section V for further discussion of FAA's role). EPA is a principal participant in the development of U.S. policy in ICAO/CAEP and other international venues. (EPA assists and technically advises FAA on aviation emissions matters.) If the ICAO Council adopts a CAEP proposal to adopt a new environmental standard, it then becomes part of the ICAO standards and recommended practices (Annex 16 to the Chicago Convention).[9]

On June 30, 1981, the ICAO Council adopted its first international standards and

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other contracting States, provided that the requirements under which such certificates or licenses were issued or rendered valid are equal to or above the minimum standards which may be established from time to time pursuant to this Convention.

[8] *Articles 87 and 88 of Chicago Convention.*

[9] ICAO, "Aircraft Engine Emissions," International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Second Edition, July 1993. Copies of this document can be obtained from ICAO (www.icao.int).

recommended practices covering aircraft engine emissions.[10] These standards limit aircraft engine emissions of NO_x, CO, and hydrocarbons (HC), in relation to other engine performance parameters, and are commonly known as stringency standards. On March 24, 1993, the ICAO Council approved a proposal adopted at the second meeting of the CAEP (CAEP/2) to tighten the original NO_x standard by 20 percent and amend the test procedures. At the next CAEP meeting (CAEP/3) in December 1995, the CAEP recommended a further tightening of 16 percent and additional test procedure amendments, but on March 20, 1997 the ICAO Council rejected this stringency proposal and approved only the test procedure amendments. At its next meeting (CAEP/4) in April 1998, the CAEP adopted a similar 16 percent NO_x reduction proposal, which the ICAO Council approved on February 26, 1999.[11] The CAEP/4 16 percent NO_x reduction standard applies to new engine designs certified after December 31, 2003 (applies only to newly certified engines).[12]

As discussed earlier, in 1997 EPA amended its regulations to adopt the 1981 ICAO NO_x and CO emission standards, as well as the NO_x emission standards and test procedures revised by ICAO in 1993. As discussed above, the U.S. has an obligation under the Convention on International Civil Aviation to notify ICAO regarding differences between U.S. standards and

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[10]ICAO, Foreword of “Aircraft Engine Emissions,” International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Second Edition, July 1993. Copies of this document can be obtained from ICAO (www.icao.int).

[11] International Civil Aviation Organization (ICAO), Aircraft Engine Emissions, Annex 16, Volume II, Second Edition, July 1993, Amendment 4 effective on July 19, 1999. Copies of this document can be obtained from ICAO (www.icao.int).

[12]These NO_x standards will be interchangeably be referred to as the 1998 CAEP/4 standards and the 1999 ICAO standards throughout this Notice.

ICAO standards, and to provide notification on the date by which the program requirements will be consistent. In response to the recent actions by ICAO and for the reasons discussed below, EPA proposes to adopt standards equivalent to ICAO's 1999 amendment to the NO_x emission standard, the test procedure changes approved by ICAO in 1997, and other technical amendments to further align EPA and ICAO requirements.

C. EPA's Responsibilities Under the Clean Air Act

As discussed earlier, section 231 of the CAA directs EPA, from time to time, to propose aircraft engine emission standards for any air pollutant that could reasonably endanger public health and welfare. In addition, EPA is required to ensure such standards' effective dates permit the development of necessary technology, giving appropriate consideration to compliance cost. Also, EPA must consult with the FAA concerning aircraft safety before proposing or promulgating emission standards. (See section V of today's proposal for further discussion of EPA's coordination with FAA and FAA's responsibilities under the CAA.)

In addition, section 233 of the CAA vests authority to implement emission standards for aircraft engines only in EPA.[13] States are preempted from taking independent action. Thus, while many states are implementing control programs to reduce mobile source emissions, EPA has the authority to establish an emission control program for aircraft engines.

[13]CAA section 233 entitled "State Standards and Controls" states that "No State or political subdivision thereof may adopt or attempt to enforce any standard respecting emissions of any air pollutant from any aircraft or engine thereof unless such standard is identical to a standard applicable to such aircraft under this part."

III. Environmental Need for Control

As mentioned above, section 231(a)(2)(A) of the CAA authorizes the EPA Administrator to, from time to time, revisit emission standards for aircraft engine emissions ”* * * which in his judgment causes, or contributes to air pollution which may * * * endanger public health or welfare.” In judging the need for the NO_x standard promulgated in today's action, the Administrator has determined (1) that the public health and welfare is endangered in several air quality regions by violation of the National Ambient Air Quality Standards (NAAQS) for ozone (NO_x contributes to the formation of ozone); and (2) that airports and aircraft are now or are projected to be, increasing sources of emissions of NO_x in some of the air quality control regions in which the NAAQS are being violated.

Nationwide, aircraft account for about 1 percent of the NO_x emissions from mobile sources.[14] Commercial aircraft emissions contribute from 74 to 99 percent of the NO_x aircraft emissions in the U.S. (Aircraft emissions sources include aircraft types used for public, private, and military purposes as follows: commercial aircraft, air taxis, general aviation, and military aircraft.[15] The current nationwide aircraft emission estimates have limitations for military

[14]U.S. EPA, “Average Annual Emissions, All Criteria Pollutants Years Including 1980, 1985, 1989-2001,” February 2003. This document is available at http://www.epa.gov/ttnchie1/trends/. A copy of this document can also be found in Docket No. OAR-2002-30. Documentation for these estimates can be accessed at http://www.epa.gov/ttn/chief/net/index.html#1999: U.S. EPA, “Documentation for Aircraft, Commercial Marine Vessel, Locomotive, and Other Nonroad Components of the National Emissions Inventory, Volume I - Methodology,” November 11, 2002. A copy of this document can also be found in Docket No. OAR-2002-30.

[15]Commercial aircraft include those aircraft used for scheduled service transporting passengers, freight, or both. Air taxis also fly scheduled service carrying passengers, freight or

aircraft emissions. Therefore, the estimated range of commercial aircraft's emissions contribution to nationwide aircraft NO_x described above is reflective of earlier and current estimates for military aircraft emissions).

Commercial aircraft emissions are projected to be a growing segment of the transportation sector's emission inventory. This growth in commercial aircraft emissions is expected to occur at a time when other significant mobile and stationary sources are drastically reducing emissions, thereby accentuating the growth in aircraft emissions. For instance, from a local/regional perspective the 1999 EPA study, *Evaluation of Air Pollutant Emissions from Subsonic Commercial Jet Aircraft*, reported that from 1990 to 2010 increases in commercial aircraft NO_x emissions for the ten cities studied (19 airport facilities with significant commercial jet aircraft activity were identified within these selected cities) are expected to range from 50 to 110 percent.[16] As an average for the ten cities, commercial aircraft's contribution to regional mobile source NO_x was anticipated to increase from about 2 percent in 1990 to about 5 percent in 2010. In addition, the study showed that in 2010 commercial aircraft are projected to contribute as much as 10 percent of total regional mobile source NO_x emissions in at least two of the cities

both, but usually are smaller aircraft and operate on a more limited basis than commercial carriers. General aviation includes most other aircraft used for recreational flying and personal transportation. Aircraft that support business travel, usually on an unscheduled basis, are included in the category of general aviation. Military aircraft cover a wide range of sizes, uses, and operating missions. While they are often similar to civil aircraft, they are handled separately because they typically operate exclusively out of military bases and frequently have distinctive flight profiles.

[16]This study (EPA420-R-99-013, April 1999) is available at http://www.epa.gov/otaq/aviation.htm. It can also be found in Docket No. OAR-2002-0030.

studied.[17]

(The above projections were made prior to the tragic events of September 11, 2001, and the subsequent economic downturn. A January 2003 report by the Department of Transportation indicated that the combination of the September 11, 2001 terrorist attacks and a cut-back in business travel had a significant and perhaps long-lasting effect on air traffic demand.[18] However, the FAA expects the demand for air travel to recover, and then continue a long-term trend of annual growth in the United States.[19] Recently, FAA reported that flights of commercial air carriers will increase by 18 percent from 2002 to 2010 and 45 percent from 2002 to 2020.[20]

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[17]Based on the one-hour ozone standard, nine of the ten metropolitan areas are currently not in attainment of NAAQS for ozone; the tenth city has attained the ozone standard and is considered an ozone "maintenance" area. See section III.A.1. of this proposal for further discussion on the ozone NAAQs. Also, for more detailed information on the 8-hour ozone standard, see the following EPA websites: http://www.epa.gov/airlinks/ozpminfo.html, http://www.epa.gov/airlinks/airlinks4.html or http://www.epa.gov/ttn/naaqs/ozone/o3imp8hr. EPA has not yet designated areas for the 8-hour standard.

[18]U.S. Department of Transportation, Office of Inspector General, "Airline Industry Metrics," CC-2203-007, January 7, 2003. A copy of this document can be found in Docket No. OAR-2002-0030.

[19]U.S. General Accounting Office, "Aviation and the Environment: Strategic Framework Needed to Address Challenges Posed by Aircraft Emissions," GAO-03-252, February 2003. This document is available at www.gao.gov/cgi-bin/getrpt?GAO-03-252, and it can also be found in the Docket No. OAR-2002-0030.

[20]The flight forecast data is based on FAA's Terminal Area Forecast System (TAFS). TAFs is the official forecast of aviation activity at FAA facilities. This includes FAA-towered airports, federally-contracted towered airports, nonfederal towered airports, and many non-towered airports. For detailed information on TAFS and the air carrier activity forecasts see the following FAA website: http://www.apo.data.faa.gov/faatafall.HTM. As of May 1, 2003, the aviation forecasts contained in TAFS for Fiscal Years 2002-2020 included the impact of the terrorists' attacks of September 11, 2001 and the recent economic downturn. However, these projections did not fully reflect the ongoing structural changes occurring within the aviation industry. A copy of the May 1, 2003 forecast summary report for air carrier activity can be found in Docket No. OAR-2002-0030.

For a comparison of an earlier (pre-9/11) FAA activity forecast to a recent (post-9/11) forecast, see the below table. We request comment on the effect that September 11, 2001, and the subsequent economic downturn have had on the projected growth of commercial aircraft emissions. Your comments will be most useful if you include appropriate and detailed supporting data and analysis.)

Table III-1 – FAA Terminal Area Forecast Summary Report of Nationwide Air Carrier Operations[21]

Year	Air Carrier Operations 12/14/00 Forecast (pre-9/11)	Percent Change 12/14/00 Forecast between years listed	Air Carrier Operations 5/1/03 Forecast (post-9/11)	Percent Change 5/1/03 Forecast between years listed
1999	15,127,419		14,776,055	
2000	15,476,135	2.3%	15,265,682	3.3%
2001	15,819,505	2.2%	14,807,303	-3.0%
2002[a]	16,210,777	2.5%	13,255,837	-10%
2005	17,455,705	7.6%	13,918,058	5.0%
2010	19,664,128	14%	15,608,349	13%
2015	22,004,067	12%	17,372,200	11%
2020	N/A[b]	--	19,249,778	11%

[a]The change in operations from 2000 to 2002 was +4.7% for the 12/14/00 forecast, and it was -13% for the 5/1/03 forecast.

[21]A copy of FAA's 12/14/00 forecast summary report (from TAFS) for air carrier activity can be found in Docket No. OAR-2002-0030.

[b]N/A = Not available

Air pollutants resulting from airport operations are emitted from several types of sources: aircraft main engines and auxiliary power units (APUs); ground support equipment (GSE) , which include vehicles such as aircraft tugs, baggage tugs, fuel trucks, maintenance vehicles, and other miscellaneous vehicles used to support aircraft operations; ground access vehicles (GAV), which include vehicles from off-site used by passengers, employees, freight operators, and other persons utilizing an airport. EPA's previous estimates show aircraft engines comprise approximately 45 percent of total air pollutant emissions from airport operations; GAV account for another 45 percent, and APUs and GSE combined make up the remaining 10 percent.[22] Since EPA has established stringent emission standards for GAVs and other motor vehicles that will be manufactured and introduced into commerce in future years, overall emissions from these vehicles will continue to decline for many years.

The emissions from aircraft engines that are being directly controlled by the standards proposed in this rulemaking are NO_x. As discussed later in this section, NO_x emissions at low

[22]The California FIP, signed by the Administrator 2/14/95, is located in EPA Air Docket A-94-09, item number V-A-1. The FIP was vacated by an act of Congress before it became effective.

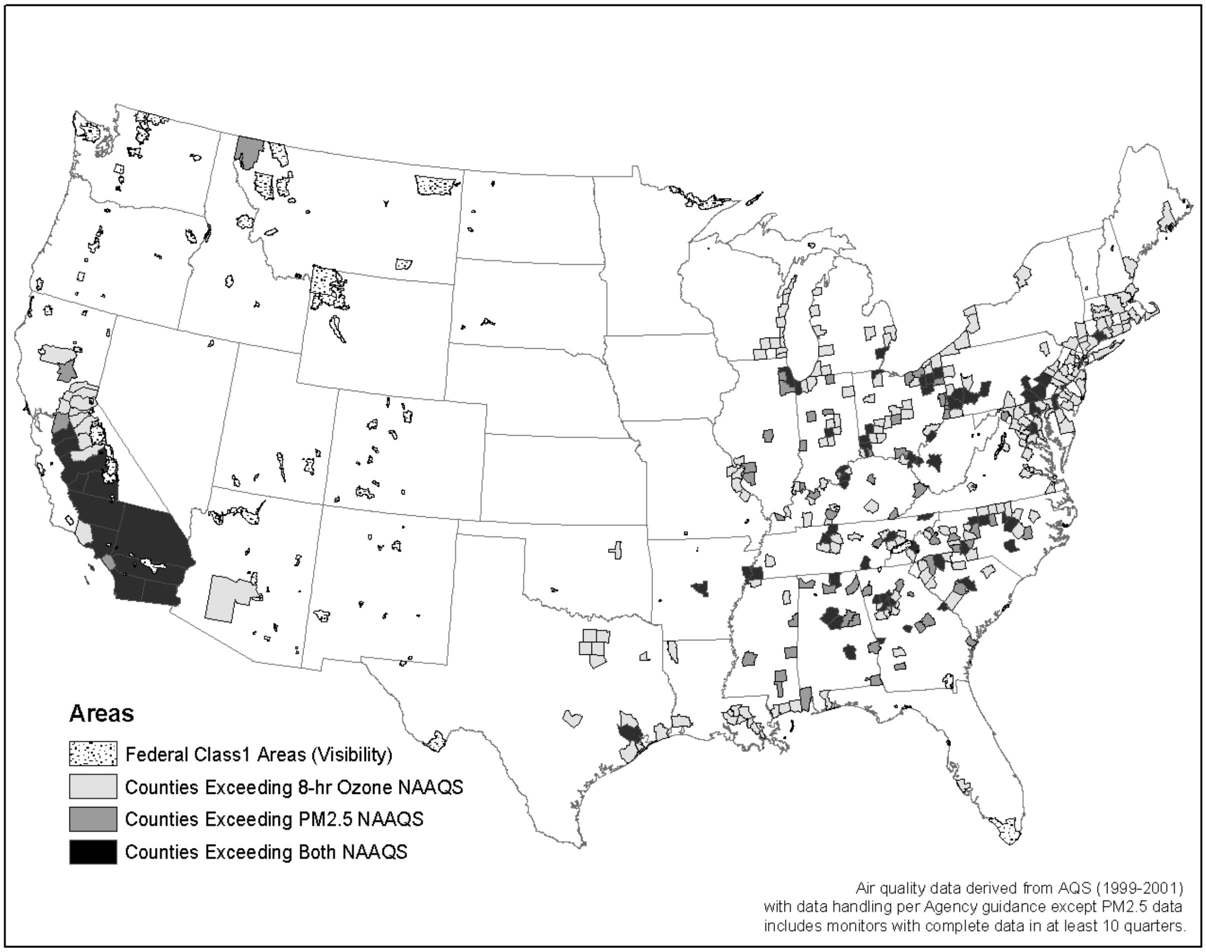
In addition, the 1997 EPA Draft Final Report entitled, "Analysis of Techniques to Reduce Air Emission at Airports" (prepared by Energy and Environmental Analysis, Inc), it was estimated that for the four airports studied (which are large air traffic hubs) on average aircraft compromise approximately 35 percent of NO_x emissions from airport operations; GAV account for another 35 percent, and APUs and GSE contribute about 15 percent each for the remaining 30 percent. This document can be found in Docket No. OAR-2002-0030.

altitude also react in the atmosphere to form secondary particulate matter ($PM_{2.5}$),[23] which is namely ammonium nitrate, and thus, secondary PM would be effected as a consequence of the proposed standards. Adopting standards equivalent to the latest ICAO NO_x emission standards and the related ICAO test procedures would help in achieving and/or maintaining compliance with the NAAQS for ozone (O_3)and PM.

There are about 111 million people living in counties with monitored concentrations exceeding the 8-hour ozone NAAQS , and over 65 million people living in counties with monitored $PM_{2.5}$ levels exceeding the $PM_{2.5}$ NAAQS. Figure III.-1 illustrates the widespread nature of these problems. Shown in this figure are counties exceeding either or both of the two NAAQS plus mandatory Federal Class I areas, which have particular needs for reductions in atmospheric haze. A discussion of the adverse effects on public health and welfare associated with these pollutants is provided below.

[23]As described later in section III.A.2., fine particles refer to those particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (also known as $PM_{2.5}$).

FIGURE III-1 -- AIR QUALITY PROBLEMS ARE WIDESPREAD



A. Public Health Impacts

1. Ozone

a. What are the health effects of ozone pollution?

Ground-level ozone pollution (sometimes called "smog") is formed by the reaction of nitrogen oxides (NO_x) and volatile organic compounds (VOC) in the atmosphere in the presence of heat and sunlight.[24] Ozone can irritate the respiratory system, causing coughing, throat irritation, and/or uncomfortable sensation in the chest.[25, 26] Ozone can reduce lung function and make it more difficult to breathe deeply, and breathing may become more rapid and shallow than normal, thereby limiting a person's normal activity. Ozone also can aggravate asthma, leading to more asthma attacks that require a doctor's attention and/or the use of additional medication. In addition, ozone can inflame and damage the lining of the lungs, which may lead to permanent

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[24]U.S. EPA, "Nitrogen Oxides: Impacts on Public Health and the Environment," EPA 452/R-97-002, August 1997. A copy of this document is available in Docket No. OAR 2002-0030.

[25]U.S. EPA (1996). Air Quality Criteria for Ozone and Related Photochemical Oxidants, EPA/600/P-93/004aF. Docket No. A-99-06. Document Nos. II-A-15 to 17.

[26]U.S. EPA. (1996). Review of National Ambient Air Quality Standards for Ozone, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA-452/R-96-007. Docket No. A-99-06. Document No. II-A-22.

changes in lung tissue, irreversible reductions in lung function, and a lower quality of life if the inflammation occurs repeatedly over a long time period (months, years, a lifetime). People who are of particular concern with respect to ozone exposures include children and adults who are active outdoors. Those people particularly susceptible to ozone effects are people with respiratory disease, such as asthma, and people with unusual sensitivity to ozone, and children. Beyond its human health effects, ozone has been shown to injure plants, which has the effect of reducing crop yields and reducing productivity in forest ecosystems.[27, 28]

The 8-hour ozone standard, established by EPA in 1997, is based on well-documented science demonstrating that more people are experiencing adverse health effects at lower levels of exertion, over longer periods, and at lower ozone concentrations than addressed by the one-hour ozone standard. (See, e.g., 62 FR 38861-38862, July 18, 1997). The 8-hour standard addresses ozone exposures of concern for the general population and populations most at risk, including children active outdoors, outdoor workers, and individuals with pre-existing respiratory disease, such as asthma.

There has been new research that suggests additional serious health effects beyond those that had been known when the 8-hour ozone health standard was set. Since 1997, over 1,700 new health and welfare studies relating to ozone have been published in peer-reviewed journals.[29]

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[27]U.S. EPA (1996). Air Quality Criteria for Ozone and Related Photochemical Oxidants, EPA/600/P-93/004aF. Docket No. A-99-06. Document Nos. II-A-15 to 17.

[28]U.S. EPA. (1996). Review of National Ambient Air Quality Standards for Ozone, Assessment of Scientific and Technical Information, OAQPS Staff Paper, EPA-452/R-96-007. Docket No. A-99-06. Document No. II-A-22.

[29]New Ozone Health and Environmental Effects References, Published Since Completion of the Previous Ozone AQCD, National Center for Environmental Assessment, Office of

Many of these studies have investigated the impact of ozone exposure on such health effects as changes in lung structure and biochemistry, inflammation of the lungs, exacerbation and causation of asthma, respiratory illness-related school absence, hospital and emergency room visits for asthma and other respiratory causes, and premature mortality. EPA is currently in the process of evaluating these and other studies as part of the ongoing review of the air quality criteria and NAAQS for ozone. A revised Air Quality Criteria Document for Ozone and Other Photochemical Oxidants will be prepared in consultation with EPA's Clean Air Science Advisory Committee (CASAC). Key new health information falls into four general areas: development of new-onset asthma, hospital admissions for young children, school absence rate, and premature mortality.

Aggravation of existing asthma resulting from short-term ambient ozone exposure was reported prior to the 1997 decision and has been observed in studies published subsequently.[30, 31] In particular, a relationship between long-term ambient ozone concentrations and the incidence of new-onset asthma in adult males (but not in females) was reported by McDonnell et al. (1999).[32] Subsequently, an additional study suggests that incidence of new diagnoses of asthma

Research and Development, US Environmental Protection Agency, Research Triangle Park, NC 27711 (7/2002). A copy of this document is available in Docket No. OAR 2002-0030.

[30]Thurston, G.D., M.L. Lippman, M.B. Scott, and J.M. Fine. 1997. Summertime Haze Air Pollution and Children with Asthma. *American Journal of Respiratory Critical Care Medicine,* 155: 654-660.

[31]Ostro, B, M. Lipsett, J. Mann, H. Braxton-Owens, and M. White (2001) Air pollution and exacerbation of asthma in African-American children in Los Angeles. *Epidemiology* 12(2): 200-208.

[32]McDonnell, W.F., D.E. Abbey, N. Nishino and M.D. Lebowitz. 1999. "Long-term ambient ozone concentration and the incidence of asthma in nonsmoking adults: the ahsmog

in children is associated with heavy exercise in communities with high concentrations (i.e., mean 8-hour concentration of 59.6 ppb) of ozone.[33] This relationship was documented in children who played 3 or more sports and thus had higher exposures and was not documented in those children who played one or two sports. The larger effect of high activity sports than low activity sports and an independent effect of time spent outdoors also in the higher ozone communities strengthened the inference that exposure to ozone may modify the effect of sports on the development of asthma in some children.

Previous studies have shown relationships between ozone and hospital admissions in the general population. A study in Toronto reported a significant relationship between 1-hour maximum ozone concentrations and respiratory hospital admissions in children under the age of two.[34] Given the relative vulnerability of children in this age category, we are particularly concerned about the findings.

Increased respiratory disease that are serious enough to cause school absences have been associated with 1-hour daily maximum and 8-hour average ozone concentrations in studies conducted in Nevada[35] in kindergarten to 6th grade and in Southern California in grades 4-

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study." *Environmental Research*. 80(2 Pt 1): 110-121.

[33]McConnell, R.; Berhane, K.; Gilliland, F.; London, S. J.; Islam, T.; Gauderman, W. J.; Avol, E.; Margolis, H. G.; Peters, J. M. (2002) Asthma in exercising children exposed to ozone: a cohort study. Lancet 359: 386-391.

[34]Burnett, R. T.; Smith_Doiron, M.; Stieb, D.; Raizenne, M. E.; Brook, J. R.; Dales, R. E.; Leech, J. A.; Cakmak, S.; Krewski, D. (2001) Association between ozone and hospitalization for acute respiratory diseases in children less than 2 years of age. Am. J. Epidemiol. 153: 444-452.

[35]Chen, L.; Jennison, B. L.; Yang, W.; Omaye, S. T. (2000) Elementary school absenteeism and air pollution. Inhalation Toxicol. 12: 997-1016.

through 6.[36] These studies suggest that higher ambient ozone levels may result in increased school absenteeism.

The air pollutant most clearly associated with premature mortality is PM, with dozens of studies reporting such an association. However, repeated ozone exposure is a possible contributing factor for premature mortality, causing an inflammatory response in the lungs which may predispose elderly and other sensitive individuals to become more susceptible to other stressors, such as PM.[37, 38, 39] Although the findings have been mixed, the findings of three recent analyses suggest that ozone exposure is associated with increased mortality. Although the National Morbidity, Mortality, and Air Pollution Study (NMMAPS) did not report an effect of ozone on total mortality across the full year, the investigators who conducted the NMMAPS study did observe an effect after limiting the analysis to summer when ozone levels are

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[36]Gilliland, FD, K Berhane, EB Rappaport, DC Thomas, E Avol, WJ Gauderman, SJ London, HG Margolis, R McConnell, KT Islam, JM Peters (2001) The effects of ambient air pollution on school absenteeism due to respiratory illnesses *Epidemiology* 12:43-54.

[37]Samet JM, Zeger SL, Dominici F, Curriero F, Coursac I, Dockery DW, Schwartz J, Zanobetti A. 2000. The National Morbidity, Mortality and Air Pollution Study: Part II: Morbidity, Mortality and Air Pollution in the United States. Research Report No. 94, Part II. Health Effects Institute, Cambridge MA, June 2000. (Docket Number A-2000-01, Document Nos. IV-A-208 and 209)

[38]Devlin, R. B.; Folinsbee, L. J.; Biscardi, F.; Hatch, G.; Becker, S.; Madden, M. C.; Robbins, M.; Koren, H. S. (1997) Inflammation and cell damage induced by repeated exposure of humans to ozone. Inhalation Toxicol. 9: 211-235.

[39]Koren HS, Devlin RB, Graham DE, Mann R, McGee MP, Horstman DH, Kozumbo WJ, Becker S, House DE, McDonnell SF, Bromberg, PA. 1989. Ozone-induced inflammation in the lower airways of human subjects. Am. Rev. Respir. Dies. 139: 407-415.

highest.[40,41] Similarly, other studies have shown associations between ozone and mortality.[42, 43] Specifically, Toulomi et al. (1997) found that 1-hour maximum ozone levels were associated with daily numbers of deaths in 4 cities (London, Athens, Barcelona, and Paris), and a quantitatively similar effect was found in a group of four additional cities (Amsterdam, Basel, Geneva, and Zurich).

In all, the new studies that have become available since the 8-hour ozone standard was adopted in 1997 continue to demonstrate the harmful effects of ozone on public health, and the need to attain and maintain the NAAQS.

b. Current and projected 8-hour ozone levels

The current primary and secondary ozone NAAQS is 0.12 ppm daily maximum 1-hour concentration, not to be exceeded more than once per year on average. EPA is replacing the

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[40]Samet JM, Zeger SL, Dominici F, Curriero F, Coursac I, Dockery DW, Schwartz J, Zanobetti A. 2000. The National Morbidity, Mortality and Air Pollution Study: Part II: Morbidity, Mortality and Air Pollution in the United States. Research Report No. 94, Part II. Health Effects Institute, Cambridge MA, June 2000. (Docket Number A-2000-01, Documents No. IV-A-208 and 209)

[41]Samet JM, Zeger SL, Dominici F, Curriero F, Coursac I, Zeger, S. Fine Particulate Air Pollution and Mortality in 20 U.S. Cities, 1987 - 1994. The New England Journal of Medicine. Vol. 343, No. 24, December 14, 2000. P. 1742-1749.

[42]Thurston, G. D.; Ito, K. (2001) Epidemiological studies of acute ozone exposures and mortality. J. Exposure Anal. Environ. Epidemiol. 11: 286-294.

[43]Touloumi, G.; Katsouyanni, K.; Zmirou, D.; Schwartz, J.; Spix, C.; Ponce de Leon, A.; Tobias, A.; Quennel, P.; Rabczenko, D.; Bacharova, L.; Bisanti, L.; Vonk, J. M.; Ponka, A. (1997) Short-term effects of ambient oxidant exposure on mortality: a combined analysis within the APHEA project. Am. J. Epidemiol. 146: 177-185.

previous 1-hour ozone standard with a new 8-hour standard. The new standard is set at a concentration of 0.08 parts per million (ppm), and the measurement period is 8 hours. Areas are allowed to disregard their three worst measurements every year and average performance over three years to determine if they meet the standard. That is, the standard is set by the 4th highest maximum 8-hour concentration.

As shown earlier (Figure III-1) unhealthy ozone concentrations exceeding the level of the 8-hour standard (i.e., not requisite to protect the public health with an adequate margin of safety) occur over wide geographic areas, including most of the nation's major population centers. These monitored areas include much of the eastern half of the U.S. and large areas of California.

Based upon data from 1999 - 2001, there are 291 counties where 111 million people live that are measuring values that violate the 8-hour ozone NAAQS.[44] An additional 37 million people live in 155 counties that have air quality measurements within 10 percent of the level of the standard.[45] These areas, though currently not violating the standard, would also benefit from the additional emission reductions from this proposed rule.

From air quality modeling performed for the recent Nonroad Diesel Engines and Fuel Control proposed rule,[46] we anticipate that without emission reductions beyond those already

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[44]Additional counties may have levels above the NAAQS but do not currently have monitors.

[45]Memorandum to Docket A-2001-11 from Fred Dimmick, Group Leader, Air Trends Group, "Summary of Currently Available Air Quality Data and Ambient Concentrations for Ozone and Particulate Matter," December 3, 2002. A copy of this document is available in Docket No. OAR 2002-0030.

[46]See the Regulatory Impact Analysis: "Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines," EPA420-R-03-008, April 2003. This document is available at http://www.epa.gov/nonroad/. A copy of this document can also be found in Docket

required under promulgated regulation and approved State Implementation Plans (SIPs), ozone nonattainment will likely persist into the future. With reductions from programs already in place, the number of counties violating the ozone 8-hour standard is expected to decrease in 2020 to 30 counties where 43 million people are projected to live. Thereafter, exposure to unhealthy levels of ozone is expected to begin to increase again. In 2030 the number of counties violating the ozone 8-hour NAAQS is projected to increase to 32 counties where 47 million people are projected to live. In addition, in 2030, 82 counties where 44 million people are projected to live will be within 10 percent of violating the ozone 8-hour NAAQS.

EPA is still developing the implementation process for bringing the nation's air into attainment with the ozone 8-hour NAAQS. On June 2, 2003 (68 FR 32802), EPA issued a proposal for the implementation process to bring the nation's air into attainment with the 8-hour ozone NAAQS.[47] The proposal seeks comment on options for planning and control requirements, along with options for making the transition from the 1-hour ozone standard to the 8-hour ozone standard. The proposal does not designate nonattainment area for the 8-hour ozone NAAQS; EPA's current plans calls for designating 8-hour ozone nonattainment areas in April 2004, under a separate process. EPA has proposed that States submit SIPs that address how areas will attain the 8-hour ozone standard within 3 years after nonattainment designation for moderate and above areas classified under subpart 2 and for some areas classified under subpart 1. EPA is also proposing that marginal areas and some areas designated under subpart 1 (i.e.,

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No. A-2001-28.

[47]A copy of this proposed rule entitled, "Proposed Rule to Implement the 8-Hour Ozone National Ambient Air Quality Standard." is available at: http://www.epa.gov/ttn/naaqs/ozone/o3imp8hr.

those with early attainment dates) will not be required to submit attainment demonstrations for the 8-hour ozone standard.   We therefore anticipate that States will submit their attainment demonstration SIPs by April 2007.

The Act contains two sets of requirements–-subpart 1 and subpart 2–-that establish requirements for State plans implementing the national ozone air quality standards in nonattainment areas. (Both are found in title I, part D.) Subpart 1 contains general requirements for SIPs for nonattainment areas for any pollutant–-including ozone--governed by a NAAQS. Subpart 2 provides more specific requirements for ozone nonattainment SIPs. Under subpart 1 of part D, Title I of the Act demonstrate that the nonattainment areas will attain the ozone 8-hour standard as expeditiously as practicable but no later than five years from the date that the area was designated nonattainment. However, based on the severity of the air quality problem and the availability and feasibility of control measures, the Administrator may extend the attainment date "for a period of no greater than 10 years from the date of designation as nonattainment." Based on these provisions, we expect that most or all areas covered under subpart 1 will attain the ozone standard in the 2007 to 2014 time frame. For areas covered under subpart 2, the maximum attainment dates provided under the Act range from 3 to 20 years after designation, depending on an area's classification. Thus, we anticipate that areas covered by subpart 2 will attain in the 2007 to 2024 time period.

Since the emission reductions expected from this proposed rule would occur during the time period when areas will need to attain the standard under either option, projected reductions in aircraft engine emissions would assist States in their effort to meet the new NAAQS. Such reductions would help them attain and maintain the 8-hour NAAQS.

2. Particulate Matter

NO_x emitted at low altitude is also a precursor in the formation of some nitrate particulate matter (PM) in the atmosphere (mostly ammonium nitrate).[48,49] Essentially all nitrate PM is of such a diameter that it is respirable in humans. As discussed earlier, aircraft account for over 1 percent of the total U.S. mobile source NO_x emissions, and aircraft's contribution to nationwide secondary PM from U.S. mobile source NO_x is expected to relatively similar.[50]

Particulate matter represents a broad class of chemically and physically diverse substances. It can be principally characterized as discrete particles that exist in the condensed (liquid or solid) phase spanning several orders of magnitude in size. PM_{10} refers to particles with an aerodynamic diameter less than or equal to a nominal 10 micrometers. Fine particles refer to those particles with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers (also known as $PM_{2.5}$), and coarse fraction particles are those particles with an aerodynamic diameter greater than 2.5 microns, but less than or equal to a nominal 10 micrometers. Ultrafine

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[48]Secondary PM is formed when NO_x reacts with ammonia in the atmosphere to yield ammonium nitrate particulate.

[49]U.S. EPA, "Nitrogen Oxides: Impacts on Public Health and the Environment," EPA 452/R-97-002, August 1997. A copy of this document is available in Docket No. OAR 2002-0030.

[50]"Benefits of Mobile Source NO_x Related Particulate Matter Reductions," Systems Applications International, EPA Contract No. 68-C5-0010, WAN 1-8, October 1996. A copy of this document is available in Docket No. OAR-2002-0030. This report concluded that, as a national average, each 100 tons of NO_x emissions will result in about 4 tons of secondary PM (conversion rate was about 0.04). This conversion rate varies from region to region, and is greatest in the West.

PM refers to particles with diameters of less than 100 nanometers (0.1 micrometers). The health and environmental effects of PM are associated with fine PM fraction and, in some cases, to the size of the particles. Specifically, larger particles (>10 µm) tend to be removed by the respiratory clearance mechanisms whereas smaller particles are deposited deeper in the lungs. Also, particles scatter light obstructing visibility.

The emission sources, formation processes, chemical composition, atmospheric residence times, transport distances and other parameters of fine and coarse particles are distinct. Fine particles are directly emitted from combustion sources and are formed secondarily from gaseous precursors such as oxides of nitrogen (NO_x). Fine particles are generally composed of sulfate, nitrate, chloride, ammonium compounds, organic carbon, elemental carbon, and metals. Aircraft engines emit NO_x which react in the atmosphere to form secondary $PM_{2.5}$ (namely ammonium nitrate). Combustion of coal, oil, diesel, gasoline, and wood, as well as high temperature process sources such as smelters and steel mills, produce emissions that contribute to fine particle formation. In contrast, coarse particles are typically mechanically generated by crushing or grinding. They include resuspended dusts and crustal material from paved roads, unpaved roads, construction, farming, and mining activities. These coarse particles can be either natural in source such as road dust or anthropogenic. Fine particles can remain in the atmosphere for days to weeks and travel through the atmosphere hundreds to thousands of kilometers, while coarse particles deposit to the earth within minutes to hours and within tens of kilometers from the emission source.

The relative contribution of various chemical components to $PM_{2.5}$ varies by region of the country. Data on $PM_{2.5}$ composition are available from the EPA Speciation Trends Network in

2001 and the **I**nteragency **M**onitoring of **PRO**tected **V**isual **E**nvironments (IMPROVE) network in 1999 covering both urban and rural areas in numerous regions of the U.S. These data show that nitrates formed from NO_x also play a major role in the western U.S., especially in the California area where it is responsible for about a quarter of the ambient $PM_{2.5}$ concentrations.

a. Health Effects of $PM_{2.5}$

Scientific studies show ambient PM is associated with a series of adverse health effects. These health effects are discussed in detail in the EPA Criteria Document for PM as well as the draft updates of this document released in the past year.[51, 52]

As described in these documents, health effects associated with short-term variation in ambient particulate matter (PM) have been indicated by epidemiologic studies showing associations between exposure and increased hospital admissions for ischemic heart disease, heart failure, respiratory disease, including chronic obstructive pulmonary disease (COPD) and pneumonia. Short-term elevations in ambient PM have also been associated with increased cough, lower respiratory symptoms, and decrements in lung function. Short-term variations in ambient PM have also been associated with increases in total and cardiorespiratory daily

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[51]U.S. EPA (1996.) Air Quality Criteria for Particulate Matter - Volumes I, II, and III, EPA, Office of Research and Development. Report No. EPA/600/P-95/001a-cF. This material is available electronically at http://www.epa.gov/ttn/oarpg/ticd.html. Available in Docket A-99-06, Document Nos. IV-A-30, IV-A-31, and IV-A-32.

[52]U.S. EPA (2002). Air Quality Criteria for Particulate Matter - Volumes I and II (Third External Review Draft) This material is available electronically at http://cfpub.epa.gov/ncea/cfm/partmatt.cfm. Available in Docket A-2001-28, Document Nos. II-A-98 and II-A-71.

mortality. Studies examining populations exposed to different levels of air pollution over a number of years, including the Harvard Six Cities Study and the American Cancer Society Study suggest an association between exposure to ambient $PM_{2.5}$ and premature mortality, including deaths attributed to lung cancer.[53, 54] Two studies further analyzing the Harvard Six Cities Study's air quality data have also established a specific influence of mobile source-related $PM_{2.5}$ on daily mortality[55] and a concentration-response function for mobile source-associated $PM_{2.5}$ and daily mortality.[56]

b. Current and Projected Levels

There are NAAQS for both PM_{10} and $PM_{2.5}$. Violations of the annual $PM_{2.5}$ standard are much more widespread than are violations of the PM_{10} standards. Figure III-1 at the beginning of this air quality section highlighted monitor locations measuring concentrations above the level of the NAAQS. As can be seen from that figure, high ambient levels are widespread throughout the country. Today's proposed aircraft NO_x standards should contribute to attainment and

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[53]Dockery, DW; Pope, CA, III; Xu, X; et al. (1993) An association between air pollution and mortality in six U.S. cities. N Engl J Med 329:1753-1759.

[54]Pope, CA, III; Thun, MJ; Namboordiri, MM; et al. (1995) Particulate air pollution as a predictor of mortality in a prospective study of U.S. adults. Am J Respir Crit Care Med 151:669-674.

[55]Laden F; Neas LM; Dockery DW; et al. (2000) Association of fine particulate matter from different sources with daily mortality in six U.S. cities. Environ Health Perspect 108(10):941-947.

[56]Schwartz J; Laden F; Zanobetti A. (2002) The concentration-response relation between PM(2.5) and daily deaths. Environ Health Perspect 110(10): 1025-1029.

maintenance of the existing PM NAAQS since NO_x contributes to the secondary formation of $PM_{2.5}$.

The NAAQS for $PM_{2.5}$ were established by EPA in 1997 (62 Fed. Reg., 38651, July 18, 1997). The short term (24-hour) standard is set at a level of 65 $\mu g/m^3$ based on the 98th percentile concentration averaged over three years. (This air quality statistic compared to the standard is referred to as the "design value.") The long-term standard specifies an expected annual arithmetic mean not to exceed 15 ug/m^3 averaged over three years.

Current $PM_{2.5}$ monitored values for 1999-2001, which cover counties having about 75 percent of the country's population, indicate that at least 65 million people in 129 counties live in areas where annual design values of ambient fine PM violate the $PM_{2.5}$ NAAQS. There are an additional 9 million people in 20 counties where levels above the NAAQS are being measured, but there are insufficient data at this time to calculate a design value in accordance with the standard, and thus determine whether these areas are violating the $PM_{2.5}$ NAAQS. In total, this represents 37 percent of the counties and 64 percent of the population in the areas with monitors with levels above the NAAQS.[57] Furthermore, an additional 14 million people live in 41 counties that have air quality measurements within 10 percent of the level of the standard. These areas, although not currently violating the standard, would also benefit from the additional reductions from this proposed rule in order to help ensure long term maintenance.

The air quality modeling performed for the recent Nonroad Diesel Engines and Fuel

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[57]Memorandum to Docket A-2001-11 from Fred Dimmick, Group Leader, Air Trends Group, "Summary of Currently Available Air Quality Data and Ambient Concentrations for Ozone and Particulate Matter," December 3, 2002. A copy of this document is available in Docket No. OAR 2002-0030.

Control proposed rule also indicates that similar conditions are likely to continue to exist in the future in the absence of additional controls.[58] For example, in 2020 based on emission controls currently adopted, we project that 66 million people will live in 79 counties with average $PM_{2.5}$ levels above 15 ug/m^3. In 2030, the number of people projected to live in areas exceeding the $PM_{2.5}$ standard is expected to increase to 85 million in 107 counties. An additional 24 million people are projected to live in counties within 10 percent of the standard in 2020, which will increase to 64 million people in 2030.

While the final implementation process for bringing the nation's air into attainment with the $PM_{2.5}$ NAAQS is still being completed in a separate rulemaking action, the basic framework is well defined by the statute. EPA's current plans call for designating $PM_{2.5}$ nonattainment areas in late-2004. Following designation, section 172(b) of the Clean Air Act allows states up to three years to submit a revision to their state implementation plan (SIP) that provides for the attainment of the $PM_{2.5}$ standard. Based on this provision, states could submit these SIPs as late as the end of 2007. Section 172(a)(2) of the Clean Air Act requires that these SIP revisions demonstrate that the nonattainment areas will attain the $PM_{2.5}$ standard as expeditiously as practicable but no later than five years from the date that the area was designated nonattainment. However, based on the severity of the air quality problem and the availability and feasibility of control measures, the Administrator may extend the attainment date "for a period of no greater than 10 years from the date of designation as nonattainment." Therefore, based on this

[58]See the Regulatory Impact Analysis: "Draft Regulatory Impact Analysis: Control of Emissions from Nonroad Diesel Engines," EPA420-R-03-008, April 2003. This document is available at http://www.epa.gov/nonroad/. A copy of this document can also be found in Docket No. A-2001-28.

information, we expect that most or all areas will need to attain the $PM_{2.5}$ NAAQS in the 2009 to 2014 time frame, and then be required to maintain the NAAQS thereafter.

B. Other Environmental Effects

The following section presents information on four categories of public welfare and environmental impacts related to NO_x and fine PM emissions: acid deposition, eutrophication of water bodies, plant damage from ozone, and visibility impairment.

1. Acid Deposition

Acid deposition, or acid rain as it is commonly known, occurs when NO_x and SO_2 react in the atmosphere with water, oxygen, and oxidants to form various acidic compounds that later fall to earth in the form of precipitation or dry deposition of acidic particles.[59] It contributes to damage of trees at high elevations and in extreme cases may cause lakes and streams to become so acidic that they cannot support aquatic life. In addition, acid deposition accelerates the decay of building materials and paints, including irreplaceable buildings, statues, and sculptures that are part of our nation's cultural heritage. To reduce damage to automotive paint caused by acid rain and acidic dry deposition, some manufacturers use acid-resistant paints, at an average cost of $5

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[59]Much of the information in this subsection was excerpted from the EPA document, *Human Health Benefits from Sulfate Reduction*, written under Title IV of the 1990 Clean Air Act Amendments, U.S. EPA, Office of Air and Radiation, Acid Rain Division, Washington, DC 20460, November 1995. A copy of this document is available in Docket No. OAR 2002-0030.

per vehicle--a total of $80-85 million per year when applied to all new cars and trucks sold in the U.S.

Acid deposition primarily affects bodies of water that rest atop soil with a limited ability to neutralize acidic compounds. The National Surface Water Survey (NSWS) investigated the effects of acidic deposition in over 1,000 lakes larger than 10 acres and in thousands of miles of streams. It found that acid deposition was the primary cause of acidity in 75 percent of the acidic lakes and about 50 percent of the acidic streams, and that the areas most sensitive to acid rain were the Adirondacks, the mid-Appalachian highlands, the upper Midwest and the high elevation West. The NSWS found that approximately 580 streams in the Mid-Atlantic Coastal Plain are acidic primarily due to acidic deposition. Hundreds of the lakes in the Adirondacks surveyed in the NSWS have acidity levels incompatible with the survival of sensitive fish species. Many of the over 1,350 acidic streams in the Mid-Atlantic Highlands (mid-Appalachia) region have already experienced trout losses due to increased stream acidity. Emissions from U.S. sources contribute to acidic deposition in eastern Canada, where the Canadian government has estimated that 14,000 lakes are acidic. Acid deposition also has been implicated in contributing to degradation of high-elevation spruce forests that populate the ridges of the Appalachian Mountains from Maine to Georgia. This area includes national parks such as the Shenandoah and Great Smoky Mountain National Parks.

A study of emissions trends and acidity of water bodies in the Eastern U.S. by the General Accounting Office (GAO) found that from 1992 to 1999 sulfates declined in 92 percent of a representative sample of lakes, and nitrate levels increased in 48 percent of the lakes sampled.[60] The decrease in sulfates is consistent with emissions trends, but the increase in nitrates is inconsistent with the stable levels of nitrogen emissions and deposition. The study suggests that the vegetation and land surrounding these lakes have lost some of their previous capacity to use nitrogen, thus allowing more of the nitrogen to flow into the lakes and increase their acidity. Recovery of acidified lakes is expected to take a number of years, even where soil and vegetation have not been "nitrogen saturated," as EPA called the phenomenon in a 1995 study.[61] This situation places a premium on reductions of NO_x (and SO_x) from all sources, including aircraft engines, in order to reduce the extent and severity of nitrogen saturation and acidification of lakes in the Adirondacks and throughout the U.S.

The NO_x reductions from today's action would help reduce acid rain and acid deposition, thereby helping to reduce acidity levels in lakes and streams throughout the country and help accelerate the recovery of acidified lakes and streams and the revival of ecosystems adversely affected by acid deposition. Reduced acid deposition levels will also help reduce stress on forests, thereby accelerating reforestation efforts and improving timber production. Deterioration of our historic buildings and monuments, and of buildings, vehicles, and other structures exposed to acid rain and dry acid deposition also will be reduced, and the costs borne to prevent acid-related damage may also decline. While the reduction in nitrogen acid deposition would be

[60] *Acid Rain: Emissions Trends and Effects in the Eastern United States, US General Accounting Office*, March, 2000 (GAO/RCED-00-47). A copy of this document is available in Docket No. OAR 2002-0030.

[61] *Acid Deposition Standard Feasibility Study: Report to Congress,* EPA 430R-95-001a, October, 1995. A copy of this document is available in Docket No. OAR-2002-0030.

roughly proportional to the reduction in NO_x emissions the precise impact of today's action would differ across different areas.

2. Eutrophication and Nitrification

Eutrophication is the accelerated production of organic matter, particularly algae, in a water body. This increased growth can cause numerous adverse ecological effects and economic impacts, including nuisance algal blooms, dieback of underwater plants due to reduced light penetration, and toxic plankton blooms. Algal and plankton blooms can also reduce the level of dissolved oxygen, which can also adversely affect fish and shellfish populations.

In 1999, NOAA published the results of a five year national assessment of the severity and extent of estuarine eutrophication. An estuary is defined as the inland arm of the sea that meets the mouth of a river. The 138 estuaries characterized in the study represent more than 90 percent of total estuarine water surface area and the total number of U.S. estuaries. The study found that estuaries with moderate to high eutrophication conditions represented 65 percent of the estuarine surface area. Eutrophication is of particular concern in coastal areas with poor or stratified circulation patterns, such as the Chesapeake Bay, Long Island Sound, or the Gulf of Mexico. In such areas, the "overproduced" algae tends to sink to the bottom and decay, using all or most of the available oxygen and thereby reducing or eliminating populations of bottom-feeder fish and shellfish, distorting the normal population balance between different aquatic organisms, and in extreme cases causing dramatic fish kills.

Severe and persistent eutrophication often directly impacts human activities. For example, losses in the nation's fishery resources may be directly caused by fish kills associated with low dissolved oxygen and toxic blooms. Declines in tourism occur when low dissolved oxygen causes noxious smells and floating mats of algal blooms create unfavorable aesthetic conditions. Risks to human health increase when the toxins from algal blooms accumulate in edible fish and shellfish, and when toxins become airborne, causing respiratory problems due to inhalation. According to the NOAA report, more than half of the nation's estuaries have moderate to high expressions of at least one of these symptoms – an indication that eutrophication is well developed in more than half of U.S. estuaries.

In recent decades, human activities have greatly accelerated nutrient inputs, such as nitrogen and phosphorous, causing excessive growth of algae and leading to degraded water quality and associated impairments of freshwater and estuarine resources for human uses.[62] Since 1970, eutrophic conditions worsened in 48 estuaries and improved in 14. In 26 systems, there was no trend in overall eutrophication conditions since 1970.[63] On the New England coast, for example, the number of red and brown tides and shellfish problems from nuisance and toxic plankton blooms have increased over the past two decades, a development thought to be linked to increased nitrogen loadings in coastal waters. Long-term monitoring in the U.S., Europe, and other developed regions of the world shows a substantial rise of nitrogen levels in surface waters, which are highly correlated with human-generated inputs of nitrogen to their watersheds.

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[62] *Deposition of Air Pollutants to the Great Waters, Third Report to Congress*, June, 2000. A copy of this document is available in Docket No. OAR 2002-0030.

[63] *Deposition of Air Pollutants to the Great Waters, Third Report to Congress*, June, 2000. Great Waters are defined as the Great Lakes, the Chesapeake Bay, Lake Champlain, and coastal waters. The first report to Congress was delivered in May, 1994; the second report to Congress in June, 1997. A copy of this document is available in Docket No. OAR 2002-0030.

Between 1992 and 1997, experts surveyed by National Oceanic and Atmospheric Administration (NOAA) most frequently recommended that control strategies be developed for agriculture, wastewater treatment, urban runoff, and atmospheric deposition.[64] In its Third Report to Congress on the Great Waters, EPA reported that atmospheric deposition contributes from 2 to 38 percent of the nitrogen load to certain coastal waters.[65] A review of peer reviewed literature in 1995 on the subject of air deposition suggests a typical contribution of 20 percent or higher.[66] Human-caused nitrogen loading to the Long Island Sound from the atmosphere was estimated at 14 percent by a collaboration of federal and state air and water agencies in 1997.[67] The National Exposure Research Laboratory, US EPA, estimated based on prior studies that 20 to 35 percent of the nitrogen loading to the Chesapeake Bay is attributable to atmospheric deposition.[68] The mobile source portion of atmospheric NO_x contribution to the Chesapeake

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[64]Bricker, Suzanne B., et al., *National Estuarine Eutrophication Assessment, Effects of Nutrient Enrichment in the Nation's Estuaries*, National Ocean Service, National Oceanic and Atmospheric Administration, September, 1999. A copy of this document is available in Docket No. OAR 2002-0030.

[65]*Deposition of Air Pollutants to the Great Waters, Third Report to Congress*, June, 2000. A copy of this document is available in Docket No. OAR 2002-0030.

[66]Valigura, Richard, et al., *Airsheds and Watersheds II: A Shared Resources Workshop*, Air Subcommittee of the Chesapeake Bay Program, March, 1997. Available in Docket A-99-06, Document No. IV-G-144.

[67]*The Impact of Atmospheric Nitrogen Deposition on Long Island Sound*, The Long Island Sound Study, September, 1997. A copy of this document is available in Docket No. OAR-2002-0030.

[68]Dennis, Robin L., *Using the Regional Acid Deposition Model to Determine the Nitrogen Deposition Airshed of the Chesapeake Bay Watershed*, SETAC Technical Publications Series, 1997.

Bay was modeled at about 30 percent of total air deposition.[69]

Deposition of nitrogen from aircraft engines contributes to elevated nitrogen levels in waterbodies. The NO_x reductions from the proposed standards would help reduce the airborne nitrogen deposition that contributes to eutrophication of watersheds, particularly in aquatic systems where atmospheric deposition of nitrogen represents a significant portion of total nitrogen loadings.

3. Plant Damage from Ozone

Ground-level ozone can also cause adverse welfare effects. Specifically, ozone enters the leaves of plants where it interferes with cellular metabolic processes. This interference can be manifest either as visible foliar injury from cell injury or death, and/or as decreased plant growth and yield due to a reduced ability to produce food. With fewer resources, the plant reallocates existing resources away from root storage, growth and reproduction toward leaf repair and maintenance. Plants that are stressed in these ways become more susceptible to disease, insect attack, harsh weather and other environmental stresses. Because not all plants are equally sensitive to ozone, ozone pollution can also exert a selective pressure that leads to changes in plant community composition.

Since plants are at the center of the food web in many ecosystems, changes to the plant community can affect associated organisms and ecosystems (including the suitability of habitats that support threatened or endangered species and below ground organisms living in the root

[69]Ibid.

zone). Given the range of plant sensitivities and the fact that numerous other environmental factors modify plant uptake and response to ozone, it is not possible to identify threshold values above which ozone is toxic and below which it is safe for all plants. However, in general, the science suggests that ozone concentrations of 0.10 ppm or greater can be phytotoxic to a large number of plant species, and can produce acute foliar injury responses, crop yield loss and reduced biomass production. Ozone concentrations below 0.10 ppm (0.05 to 0.09 ppm) can produce these effects in more sensitive plant species, and have the potential over a longer duration of creating chronic stress on vegetation that can lead to effects of concern such as reduced plant growth and yield, shifts in competitive advantages in mixed populations, and decreased vigor leading to diminished resistance to pests, pathogens, and injury from other environmental stresses.

Studies indicate that these effects described here are still occurring in the field under ambient levels of ozone. The economic value of some welfare losses due to ozone can be calculated, such as crop yield loss from both reduced seed production (e.g., soybean) and visible injury to some leaf crops (e.g., lettuce, spinach, tobacco) and visible injury to ornamental plants (i.e., grass, flowers, shrubs), while other types of welfare loss may not be fully quantifiable in economic terms (e.g., reduced aesthetic value of trees growing in Class I areas).

As discussed earlier, aircraft engine emissions of NO_x contribute to ozone. The proposed standards would aid in the reduction of ozone and, therefore, help reduce crop damage and stress from ozone on vegetation.

4. Visibility

The secondary PM NAAQS is designed to protect against adverse welfare effects which includes visibility impairment. In 1997, EPA established the secondary $PM_{2.5}$ NAAQS as equal to the primary (health-based) NAAQS of 15 ug/m^3 (based on a 3-year average of the annual mean) and 65 ug/m^3 (based on a 3-year average of the 98^{th} percentile of the 24-hour average value) (62 FR 38669, July 18, 1997). EPA concluded that $PM_{2.5}$ causes adverse effects on visibility in various locations, depending on PM concentrations and factors such as chemical composition and average relative humidity. In 1997, EPA demonstrated that visibility impairment is an important effect on public welfare and that unacceptable visibility impairment is experienced throughout the U.S., in multi-state regions, urban areas, and remote federal Class I areas. In many cities having annual mean $PM_{2.5}$ concentrations exceeding annual standard, improvements in annual average visibility resulting from the attainment of the annual $PM_{2.5}$ standard are expected to be perceptible to the general population. Based on annual mean monitored $PM_{2.5}$ data, many cities in the Northeast, Midwest, and Southeast as well as Los Angeles would be expected to experience perceptible improvements in visibility if the $PM_{2.5}$ annual standard were attained.

Furthermore, in setting the $PM_{2.5}$ NAAQS, EPA acknowledged that levels of fine particles below the NAAQS may also contribute to unacceptable visibility impairment and regional haze problems in some areas, and section 169 of the Act provides additional authorities to remedy existing impairment and prevent future impairment in the 156 national parks, forests and wilderness areas labeled as mandatory Federal Class I areas (62 FR 38680-81, July 18, 1997).

Visibility can be defined as the degree to which the atmosphere is transparent to visible light.[70] Fine particles with significant light-extinction efficiencies include organic matter, sulfates, nitrates, elemental carbon (soot), and soil. Size and chemical composition of particles strongly affects their ability to scatter or absorb light. Nitrates typically contribute 1 to 6 percent of average light extinction on haziest days in rural Eastern U.S. locations.[71]

Visibility is important because it directly affects people's enjoyment of daily activities in all parts of the country. Individuals value good visibility for the well-being it provides them directly, both in where they live and work, and in places where they enjoy recreational opportunities. Visibility is also highly valued in significant natural areas such as national parks and wilderness areas, because of the special emphasis given to protecting these lands now and for future generations.

To quantify changes in visibility, we compute a light-extinction coefficient, which shows the total fraction of light that is decreased per unit distance. Visibility can be described in terms of visual range or light extinction and is reported using an indicator called deciview.[72] In

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[70]National Research Council, 1993. Protecting Visibility in National Parks and Wilderness Areas. National Academy of Sciences Committee on Haze in National Parks and Wilderness Areas. National Academy Press, Washington, DC. This book can be viewed on the National Academy Press Website at http://www.nap.edu/books/0309048443/html/. See also U.S. EPA Air Quality Criteria Document for Particulate Matter (1996) (available on the internet at http://cfpub.epa.gov/ncea/cfm/partmatt.cfm) and Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. These documents can be found in Docket A-99-06, Documents No. II-A-23 and IV-A-130-32.

[71]US EPA Trends Report 2001. This document is available on the internet at http://www.epa.gov/airtrends/. A copy of this document is available in Docket No. OAR 2002-0030.

[72]Visual range can be defined as the maximum distance at which one can identify a black object against the horizon sky. It is typically described in miles or kilometers. Light extinction is

addition to limiting the distance that one can see, the scattering and absorption of light caused by air pollution can also degrade the color, clarity, and contrast of scenes.

In addition, visibility impairment can be described by its impact over various periods of time, by its source, and the physical conditions in various regions of the country. Visibility impairment can be said to have a time dimension in that it might relate to short-term excursions or to longer periods (e.g., worst 20 percent of days and annual average levels). Anthropogenic contributions account for about one-third of the average extinction coefficient in the rural West and more than 80 percent in the rural East. In the Eastern U.S., reduced visibility is mainly attributable to secondarily formed particles, particularly those less than a few micrometers in diameter. While secondarily formed particles still account for a significant amount in the West, primary emissions contribute a larger percentage of the total particulate load than in the East.

Furthermore, it is important to note that even in those areas with relatively low concentrations of anthropogenic fine particles, such as the Colorado Plateau, small increases in anthropogenic fine particulate concentrations can lead to significant decreases in visual range. This is one of the reasons mandatory Federal Class I areas have been given special consideration under the Clean Air Act.[73]

Taken together with other programs, reductions from this proposal would help to improve

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the sum of light scattering and absorption by particles and gases in the atmosphere. It is typically expressed in terms of inverse megameters (Mm^{-1}), with larger values representing worse visibility. The deciview metric describes perceived visual changes in a linear fashion over its entire range, analogous to the decibel scale for sound. A deciview of 0 represents pristine conditions. Under many scenic conditions, a change of 1 deciview is considered perceptible by the average person.

[73]The Clean Air Act designates 156 national parks and wilderness areas as mandatory Federal Class I areas for visibility protection.

visibility across the nation, including mandatory Federal Class I areas.

C. Other Criteria Pollutants Affected by This Proposed Rule

The standards being proposed today would also help reduce levels of nitrogen dioxide (NO_2), for which NAAQS have been established. Currently, every area in the United States has been designated to be in attainment with the NO_2 NAAQS.

IV. Description of Action

Under the authority of section 231 of the CAA, EPA today proposes to adopt standards equivalent to ICAO's February 1999 NO_x emission standards (these NO_x standards were adopted at CAEP/4 in 1998 and approved by the ICAO Council in 1999) and March 1997 test procedure amendments. Today's proposed emission standards and test procedure amendments apply to commercial aircraft engines; no general aviation or military engines are covered by today's proposal. The commercial aircraft engines subject to today's proposed NO_x standards are those gas turbine engines that are newly certified (and designed) after the effective date of the proposed regulations. (Newly manufactured or already certified engines built after the effective date of the proposed regulations would not have to meet these standards.) For the sake of consistency and harmonization, the effective dates below for the proposed NO_x standards are identical with those of the ICAO 1999 NO_x standards. The proposed NO_x emission standards, test procedure amendments, and their effective dates are described below.

A. What Emission Standards Are Under Consideration?

As discussed earlier in sections II and III of today's notice, section 231(a)(2)(A) of the CAA authorizes EPA to establish emission standards for aircraft engine emissions "...which in [her] judgment causes, or contributes to, air pollution which may reasonably be anticipated to endanger public health or welfare." The Administrator may revise such standards from "time to time." CAA section 231(b) requires that any emission standards provide sufficient lead time "to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance within such period."

Today's rule proposes near-term standards that would go into effect in 2004 to ensure future engines do not jeopardize recent or past technology gains. These standards are equivalent to the CAEP/4 NO_x international consensus emissions standards for aircraft engines adopted by ICAO's CAEP in 1998.[74] EPA intends to promulgate these standards by January 2004 in order to be consistent with U.S. obligations under ICAO. At the same time, EPA anticipates establishing more stringent NO_x standards in the future. EPA will participate at CAEP/6 (sixth meeting of CAEP), which is scheduled in February 2004, to establish more stringent international consensus emission standards for aircraft engines. Such standards would likely be a central consideration in a future EPA regulation of aircraft engine emissions.

We believe this two-step approach is the most appropriate means to address emissions from aircraft engines in this rulemaking. It would codify current practice, with no significant

[74]ICAO, CAEP, Fourth Meeting, Montreal, Quebec, April 6-8, 1998, Report, Document 9720, CAEP/4. Copies of this document can be obtained from the ICAO website located at www.icao.int.

lead time, as a near-term approach.[75] EPA has authority to revise emission standards from "time to time". EPA intends to address more stringent emission standards requiring more lead time in a future rulemaking (see section IV.A.5. for further discussion of future standards).

1. Today's Proposed NO_x Standards

EPA proposes to adopt standards equivalent to ICAO's 1999 NO_x emission standards for newly certified aircraft gas turbine engines (turbofan and turbojet engines) of rated thrust or output greater than 26.7 kilonewtons (kN) with compliance dates as follows:[76]

For engines of a type or model of which that date of manufacture of the first individual production model was after December 31, 2003:

a) for engines with a pressure ratio of 30 or less:

i) for engines with a maximum rated output of more than 89.0 kN:

NO_x = (19 + 1.6(rated pressure ratio))g/kN(rated output)

ii) for engines with a maximum rated output of more than 26.7 kN but not more than 89.0 kN:

NO_x = (37.572 + 1.6(rated pressure ratio) - 0.2087(rated output))g/kN(rated output)

b) for engines with a pressure ratio of more than 30 but less than 62.5:

[75]As described later, more information and greater lead time would be necessary to require more stringent standards.

[76]This proposal includes standards for low-, mid-, and high-thrust engines (see below for further discussion of the different standards based on the thrust of the engines) .

i) for engines with a maximum rated output of more than 89.0 kN:

NO_x = (7 + 2.0(rated pressure ratio))g/kN(rated output)

ii) for engines with a maximum rated output of more than 26.7 kN but not more than 89.0 kN:

NO_x = (42.71 + 1.4286(rated pressure ratio) - 0.4013(rated output) + 0.00642(rated pressure ratio × rated output))g/kN(rated output)

c) for engines with a pressure ratio of 62.5 or more:

NO_x = (32 + 1.6(rated pressure ratio))g/kN(rated output).

The NO_x emission standards presented above are equivalent to the ICAO NO_x standards that have an implementation date of December 31, 2003.[77]

2. Proposed NO_x Standards for Newly Certified Mid- and High-Thrust Engines

EPA is proposing to adopt NO_x standards for newly certified mid- and high-thrust engines (those engines designed and certified after the effective date of the proposed regulations, which have a rated output or thrust greater than 89 kN) that generally represent about a 16 percent reduction (or increase in stringency) from the existing standard. (See section IV.A.1(a)(i) and

[77]ICAO's CAEP/4 NO_x standards became effective July 19, 1999, and applicable as of November 4, 1999. December 31, 2003 is the implementation date for these standards. However, for the purpose of this Notice the effective date is considered the implementation date. (ICAO, "Aircraft Engine Emissions," International Standards and Recommended Practices, Environmental Protection, Annex 16, Volume II, Second Edition, July 1993 – Amendment 4, July 19, 1999.)

IV.A.1(b)(i) above for the standards for mid- and high-thrust engines.) More specifically, at a rated pressure ratio of 30 the proposed NO_x standards represent a 16 percent reduction from the existing standard. At rated pressure ratios of 10 and 20 , the proposed standards correspond to 27 and 20 percent reductions, respectively. In addition, at rated pressure ratios of 40 and 50, the proposed NO_x standards signify 9 and 4 percent reductions, respectively. Also, the proposed and existing standards are equivalent at a rated pressure ratio of 62.5. See Figure IV.B-1 in section IV.B. for a comparison of the proposed NO_x standards (equivalent to CAEP/4 standards) to the existing standards (equivalent to CAEP/2 standards) .

3. Proposed NO_x Standards for Newly Certified Low-Thrust Engines

For newly certified low-thrust engines (engines with a thrust or rated output of more than 26.7 kN but not more than 89.0 kN), EPA is today proposing to adopt near-term NO_x standards that are different than the standards proposed for mid- and high-thrust engines (engines with thrust greater than 89.0 kN).[78] In addition to rated pressure ratio, the proposed standards for low-thrust engines would also be dependent on an engine's thrust or rated output.[79] (See section IV.A.1(a)(ii) and IV.A.1(b)(ii) for a description of these different standards.) For example, at a

[78]Today's proposed NO_x standards for low thrust or small engines specify that engines with a rated output or thrust at 26.7 kN meet the existing standard, and engines with a rated output at 89 kN meet the proposed (or CAEP/4) standards. For engines with rated outputs or thrust levels between 26.7 and 89 kN, a linear interpolation was made between the low range of the existing standard and the high range of the proposed standard based upon the rated output to determine the proposed NO_x limits for such engines. Thus, thrust dependent standards are being proposed for engines with rated output or thrust between 26.7 kN and 89 kN.

[79]The proposed standards for mid- and high-thrust engines are dependent only on an engine's rated pressure ratio.

rated pressure ratio of 30 and a thrust of 58 kN (thrust level in the middle of 26.7 kN and 89 kN), these proposed standards are an 8 percent reduction (or increase in stringency) from the existing standard compared to a 16 percent reduction for the proposed standards for mid- and high-thrust engines.[80]

The existing standards were not set at a stringency level that created a need for low-thrust engines to have different requirements, but at the level of NO_x stringency proposed today different requirements are considered necessary for such engines. Due to their physical size, it is difficult to apply the best NO_x reduction technology to low thrust or small engines. The difficulty increases progressively as size is reduced (from around 89 kN).[81] For example, the relatively small combustor space and section height of these engines creates constraints on the use of low NO_x fuel staged combustor concepts which inherently require the availability of greater flow path cross-sectional area than conventional combustors.[82] Also, fuel staged combustors need more fuel injectors, and this need is not compatible with the relatively lower

[80]Additional examples of the proposed standards for low-thrust engines in comparison to the proposed standards for mid- and high-thrust engines are provided below. At rated pressure ratios of 10 and 20 with a thrust of 58 kN, the proposed low-thrust engine standards are a 14 and 10 percent reduction from the existing standard, respectively. Whereas, at these same rated pressure ratios, the proposed standards for mid- and high-thrust engines are 27 and 20 percent reductions.
In addition, at rated pressure ratios of 40 and 50 with a thrust of 58 kN, these low-thrust engine standards signify a 5 and 2 percent reduction from the existing standard, respectively. In comparison, at these same rated pressure ratios, the proposed standards for mid- and high-thrust engines are 9 and 4 percent reductions.

[81]ICAO/CAEP, Report of Third Meeting, Montreal, Quebec, December 5-15, 1995, Document 9675, CAEP/3.

[82]"The burner section of an aircraft engine, which contains the combustion chamber, burns a mixture of fuel and air, and delivers the resulting gases to the turbine at a temperature which will not exceed the allowable limit at the turbine inlet." (United Technologies Pratt and Whitney, "The Aircraft Gas Turbine Engine and Its Operation," August 1998.)

total fuel flows of lower thrust engines. (Reductions in fuel flow per nozzle are difficult to attain without having clogging problems due to the small sizes of the fuel metering ports.) In addition, lower thrust engine combustors have an inherently greater liner surface-to-combustion volume ratio, and this requires increased wall cooling air flow. Thus, less air would be available to obtain acceptable turbine inlet temperature distribution and for emissions control.[83] Since the difficulties increase progressively as engine thrust size is reduced, EPA believes it would be appropriate to make a graded change in stringency of the proposed NO_x standards for low-thrust engines.

4. Rationale of Proposed NO_x Standards for Newly Certified Low-, Mid-, and High-Thrust Engines

The proposed standards for low-, mid-, and high-thrust engines, which are equivalent to the CAEP/4 standards, ensure that new engine designs would incorporate the existing combustor technology and would not perform worse than today's current engines. EPA intends to promulgate these standards by January 2004 in order to be consistent with U.S. obligations under ICAO. (See section II.B for a discussion of the obligation of ICAO's participating nations). At this time, there is not sufficient lead time to require more stringent emission standards than the CAEP/4 NO_x emission standards by January 2004. As discussed later in section IV.A.5 for future standards, we are deferring action on more stringent NO_x standards because pursuant to

[83]ICAO/CAEP Working Group 3 (Emissions), "Combined Report of the Certification and Technology Subgroups," section 2.3.6.1, Presented by the Chairman of the Technology Subgroup, Third Meeting, Bonn, Germany, June 1995. A copy of this paper can be found in Docket OAR-2002-0030.

section 231(b) of the CAA we need more time to better understand the cost of compliance with such standards, and additional cost data is expected to be available from CAEP/6 in February 2004 (see section IV.A.5 for further discussion regarding lead time).

EPA believes that the proposed standards would not impose any additional burden on manufacturers, because manufacturers are already designing new engines to meet the ICAO international consensus standards by 2004 (see section VII of today's action for further discussion of regulatory impact). Even though the U.S. did not immediately adopt the ICAO NO_x standards after 1999, engine manufacturers have continued to make progress in reducing these emissions. Today's proposed standards are aimed at assuring that this progress is not reversed in the future.

5. Future NO_x Standards for Newly Certified Low-, Mid-, and High-Thrust Engines

More stringent standards for low-, mid-, and high-thrust engines will be necessary in the future. As discussed earlier in section III, the growth in aircraft emissions is projected to occur at a time when other mobile source categories are reducing emissions.[84] The 1999 EPA study of

[84]The projected growth in aircraft emissions is not simply from the number of operations, but it could also be attributed to the change in the types of aircraft being operated. For example, regional aircraft activity is growing (regional aircraft are generally referred to as those aircraft with more than 19 but fewer than 100 seats – regional jets and turboprops). In the U.S., traffic flown by regional airlines increased about 20 percent in 1999 and is expected to grow approximately 7 percent annually during the next ten years, compared to 4 to 6 percent for the major airlines. In addition, regional jets comprised about 25 percent of the regional aircraft fleet in 2000, up from only 4.2 percent in 1996, and their fraction of the fleet is expected to increase to nearly 50 percent by 2011. Regional aircraft are 40 to 60 percent less fuel efficient compare to larger narrow- and wide-body aircraft, and regional jets are 10 to 60 percent less fuel efficient than turboprop aircraft. However, fuel costs have less of an effect on the operating costs of regional aircraft compared to large aircraft. In addition, regional jets have historically operated at

commercial aircraft activity in ten cities projected that the aircraft NO_x emissions would double in some of these cities by 2010, and the aircraft component of the regional mobile source NO_x emissions in the ten cities would grow from a range of 1 to 4 percent that existed in 1990 to a range of 2 to 10 percent in 2010.[85] (As indicated earlier, the above projections were made prior to the tragic events of September 11, 2001, and the subsequent economic downturn. A January 2003 report by the Department of Transportation indicated that the combination of the September 11, 2001 terrorist attacks and a cut-back in business travel had a significant and perhaps long-lasting effect on air traffic demand. However, the FAA expects the demand for air travel to recover, and then continue a long-term trend of annual growth in the United States.) More recently, as discussed earlier FAA reports that flights (or activity) of commercial air carriers will increase by 18 percent by 2010 and 45 percent by 2020.[86] Thus, based on these trends more stringent NO_x standards than the proposed standards are needed in the future to

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higher load factors than turboprops due to their popularity with travelers. (R. Babikian, S. P. Lukachko and I. A. Waitz, "Historical Fuel Efficiency Characteristics of Regional Aircraft from Technological, Operational, and Cost Perspectives," *Journal of Air Transport Management*, Volume 8, No. 6, pp. 389-400, Nov. 2002.

[85]U.S. EPA, "Evaluation of Air Pollutant Emissions from Subsonic Commercial Jet Aircraft," April 1999, EPA420-R-99-013. This study is available at http://www.epa.gov/otaq/aviation.htm. It can also be found in Docket No. OAR-2002-0030.

[86]The flight forecast data is based on FAA's Terminal Area Forecast System (TAFS). TAFs is the official forecast of aviation activity at FAA facilities. This includes FAA-towered airports, federally-contracted towered airports, nonfederal towered airports, and many non-towered airports. For detailed information on TAFS and the air carrier activity forecasts see the following FAA website: http://www.apo.data.faa.gov/faatafall.HTM. As of May 1, 2003, the aviation forecasts contained in TAFS for Fiscal Years 2002-2020 included the impact of the terrorists' attacks of September 11, 2001 and the recent economic downturn. However, these projections did not fully reflect the ongoing structural changes occurring within the aviation industry. A copy of the May 1, 2003 forecast summary report for air carrier activity can be found in Docket No. OAR-2002-0030.

reduce aircraft NO_x emissions in nonattainment areas.

Further stringency of the NO_x standards would reduce the expected growth in commercial aircraft emissions. The importance of controlling aircraft emissions has grown in many areas (especially areas not meeting the 1-hour and 8-hour ozone NAAQS) as controls on other sources become more stringent and attainment of the NAAQS's has still not been achieved. (Many airports in the U.S. are located in nonattainment areas.[87]) As activity increases, aircraft would emit increasing amounts of NO_x in many nonattainment areas, and thus, aircraft emissions would further aggravate the problems in these areas (either by emitting pollutants directly within a nonattainment area or by contributing to regional transport emissions in an area upwind of a nonattainment area). More stringent aircraft engine NO_x standards would assist in alleviating these problems in nonattainment areas, and they would aid in preventing future concerns in areas currently designated as attainment (or maintenance) areas. In addition, attainment or maintenance of the NAAQS requires that aircraft engines be subject to a program of control compatible with their significance as pollution sources.

EPA, therefore, is considering more stringent future standards, beyond today's proposed standards. Leading up to CAEP/6 in February 2004, one of the objectives of CAEP (and/or the international aviation community) is to consider more stringent aircraft engine standards than

[87]For information on the geographic location of airports, see the following U.S. Department of Transportation (Bureau of Transportation Statistics) website: www.bts.gov/oai. The report or database provided on the website entitled, "Airport Activity Statistics of Certificated Air Carriers: Summary Tables 2000," lists airports by community. In addition, see the following EPA website for information on nonattainment areas for criteria pollutants: www.epa.gov/oar/oaqps/greenbk.

CAEP/4 standards for all gaseous emissions, especially NO_x.[88] ICAO CAEP working groups are currently assessing the technological feasibility, economic reasonableness, and environmental benefit of imposing more stringent NO_x emissions standards for aircraft engines beyond that which will become effective in 2004 (CAEP/4 standards). Options being considered range from 5 to 30 percent more stringent with an effective date as early as 2008 to 2012 (these options are accompanied by more stringent standards for low-thrust engines).[89] Based on the results of this assessment, a proposal for more stringent NO_x standards is expected to be made at CAEP/6.[90] (No changes to the standards of other pollutants, hydrocarbons and carbon monoxide, are anticipated.) Activity is also underway to identify and assess the potential for long-term technology goals to be established for further emissions reductions.[91,92] The aim of the goal

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[88] ICAO, CAEP, Fifth Meeting, Montreal, Quebec, January 1-17, 2001, "Report on Agenda Item 4," CAEP/5-WP/86, January 17, 2001. Copies of this document can be obtained from ICAO (www.icao.int).

[89] ICAO, CAEP, Steering Group Meeting, Paris, France, September 10-13, 2002, "Summary of Discussions and Decisions of the Second Meeting of the Steering Group," September 11, 2002, CAEP-SG20022-SD/2. A copy of this paper can be found in Docket OAR-2002-0030. Since this paper was written, the working groups have also decided to consider the range of stringency options for an effective date of 2008.

[90] ICAO, CAEP, Steering Group Meeting, Paris, France, September 10-13, 2002, "Summary of Discussions and Decisions of the First Meeting of the Steering Group," September 10, 2002, CAEP-SG20022-SD/1. A copy of this paper can be found in Docket OAR-2002-0030.

[91] ICAO, CAEP, Fifth Meeting, Montreal, Quebec, January 1-17, 2001, "Report on Agenda Item 4," CAEP/5-WP/86, January 17, 2001. Copies of this document can be obtained from ICAO (www.icao.int).

[92] For the purpose of setting long-term technology goals, activity on the below tasks was initiated after CAEP/5 in 2001, and it is expected to continue beyond CAEP/6.
(a) characterize emissions performance of future technologies being pursued under national and international research programs, including technology readiness;
(b) develop methodologies for quantifying aviation emissions inventories;
(c) develop forecasts of emission trends both locally and globally; and

setting activity is to complement the ICAO CAEP standard setting process with information to aid the engine and airframe manufacturer's design process. The goals are expected to take into account the results of recently completed emissions reduction technology programs such as those conducted by National Aeronautics and Space Administration (NASA) and the European Commission and the timeline necessary to carry those technologies from the research phase through commercialization.[93] EPA is currently working with FAA and CAEP working groups (as described in section V) in the evaluation of NO_x stringency options for CAEP/6 and the potential for long-term technology goals.

Manufacturers should be able to achieve additional reductions with more lead time than is provided by today's proposal. After CAEP/6, we would assess whether or not the new international consensus and longer-term standards (which are expected to be adopted) would be stringent enough to protect the U.S. public health and welfare. If so, we would propose to adopt the CAEP/6 NO_x standards soon thereafter. EPA (or the U.S.) retains the discretion to adopt more stringent standards in the future if the international consensus standards ultimately prove insufficient to protect U.S. air quality.

Deferring consideration of more stringent future standards until after CAEP/6 would allow us to obtain important additional information on the costs of such standards.[94] As

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(d) examine how such goals might be applied within the current regulatory regime.

[93]ICAO, CAEP, Fourth Meeting, Montreal, Quebec, April 6-8, 1998, Report, Document 9720, CAEP/4, see Appendix A to the Report on Agenda Item 4 (page 4-A-1). Copies of this document can be obtained from ICAO (www.icao.int).

[94]For low-thrust engines, deferring regulatory action on more stringent future standards until after CAEP/6 would also enable us to obtain additional information on the technological feasibility of such standards.

described earlier in this notice, section 231 of the CAA authorizes EPA from "time to time" to revisit emission standards, and it requires that any standards' effective dates permit the development of necessary technology, giving appropriate consideration to the cost. We are not proposing more stringent NO_x standards today primarily because we need more time to better understand the cost of compliance of such standards, and additional cost data is expected to be available from CAEP/6 in February 2004. Producing (and/or developing) new engines or engine technologies requires significant financial investments from engine manufacturers, which takes time to recoup (the amount of time depends upon sales of engines, replacement parts, etc.). As discussed earlier, CAEP working groups are currently analyzing the costs and emission benefits (taking into account lead time) for the options of further NO_x stringency (beyond the CAEP/4 standards) being considered for CAEP/6.[95] After evaluating such information, we would then be better situated to make decisions on an appropriate level of stringency and implementation timing that maximizes emission reductions from aircraft engines, taking into consideration cost.

In addition, if we address more stringent future standards in accordance with CAEP/6 action, we would have the benefits of harmonizing with international standards.[96] Due to the international nature of the aviation industry, setting NO_x standards at the appropriate level to meet U.S. air quality needs through international consensus provides the potential for greater environmental benefits. Aircraft and aircraft engines are international commodities, and they are

[95]Specifically, the Forecasting and Economic Analysis Support Group (FESG) is conducting an analysis of the costs and emission benefits for the further stringency options.

[96]As discussed earlier, the U.S. has an obligation to be compatible with the ICAO program if deemed appropriate.

designed and built to meet international standards. Adoption of international standards ensures emission reductions from domestic and foreign aircraft in the U.S. In addition, international consensus standards lead to air quality benefits in the U.S. and throughout the world.

B. Already Certified, Newly Manufactured Engines

Under current rules, the proposed NO_x standards would not apply to already certified, newly manufactured engines (in-production engines or engines built after the effective date of the proposed standards), and the rationale for not applying these standards to already certified low-, mid-, and high-thrust engines is discussed below. Nearly all already certified engines (94 percent of in-production engine models in the ICAO Aircraft Engine Exhaust Emissions Data Bank[97]) currently meet or perform better than the standards we are proposing to adopt today.[98] (See

[97] International Civil Aviation Organization (ICAO), Aircraft Engine Exhaust Emissions Data Bank, July 2002. This data bank is available at http://www.qinetiq.com/aircraft.html. In addition, a copy of a table including data of engine NO_x emissions from the ICAO data bank and their margin to the proposed NO_x standards can be found in Docket OAR-2002-0030.

[98] 116 out of 124 (94 percent) engine models that are currently in production perform better than the CAEP/4 NO_x standards. The 8 engine models (which are mid- and high-thrust engines) that are not achieving the CAEP/4 NO_x standards are from three different Pratt and Whitney (PW) engine types or families (engines and their thrust variants with the same build standard). These engines are the following: (1) JT8D-217C E-kit and JT8D-219 E-kit; (2) PW4077D, PW4084D, and PW4090; and (3) PW4164, PW4168, and PW4168A. (See Figure IV.B-1 below that specifically shows these 8 in-production models in relation to the CAEP/4 or proposed NO_x standards.) For the year 2000, these 8 engine models were found on approximately 751 out of 20,137 (3.7 percent) aircraft owned by U.S. carriers and accounted for approximately 1,541,172 out of 11,505,063 (13.4 percent) of U.S. domestic flights.

(The above reference for the fleet fraction is BACK Aviation Solutions, www.backaviation.com/Information_Services/default.htm..

The domestic flight information is based on SAGE, the System for Assessing Aviation Emissions. SAGE is an FAA model that estimates aircraft emissions through the full flight

Figure IV.B-1 below for a comparison of the NO_x emission levels of current in-production engines to the CAEP/4 NO_x standards.[99]) At the time the CAEP/4 NO_x standards were adopted in 1998, all but 11 in-production engines and 5 newly designed engine models (these 5 engines were in the design and development process in 1998) had NO_x emission levels that would perform better than the CAEP/4 standards.[100] Based on a recent CAEP working group (specifically, the Forecasting and Economic Analysis Support Group - FESG) analysis of applying the CAEP/4 standards to already certified engines (at dates 2, 4, and 6 years after the implementation date for newly certified engines), from those 16 engine models identified in 1998 today there are only 4 already certified engine models or two engine families remaining that would not meet the CAEP/4 standards.[101] The other engine models have either, through

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profile using non-proprietary input data, such as BACK, FAA's Enhanced Traffic Management System (ETMS), and the Official Airline Guide (OAG). The year 2000 air traffic movements database portion of SAGE was used to estimate the number of flights using the subject engines.)

[99] For Figure IV.B-1, the Allison, Rolls-Royce, and Textron Lycoming engines with rated pressure ratios less than 20 and NO_x levels above the CAEP/4 NO_x standards actually perform better than the standards, since there are different CAEP/4 NO_x standards for these low-thrust engines (see section IV.A.3 for further discussion of NO_x standards for low thrust engines). (16 of the 124 engines, 13 percent of engine models in production, in Figure IV.B-1 and the ICAO Aircraft Engine Exhaust Emissions Data Bank are low–thrust engines – engines with thrust greater than 26.7 kN but not more than 89 kN.)

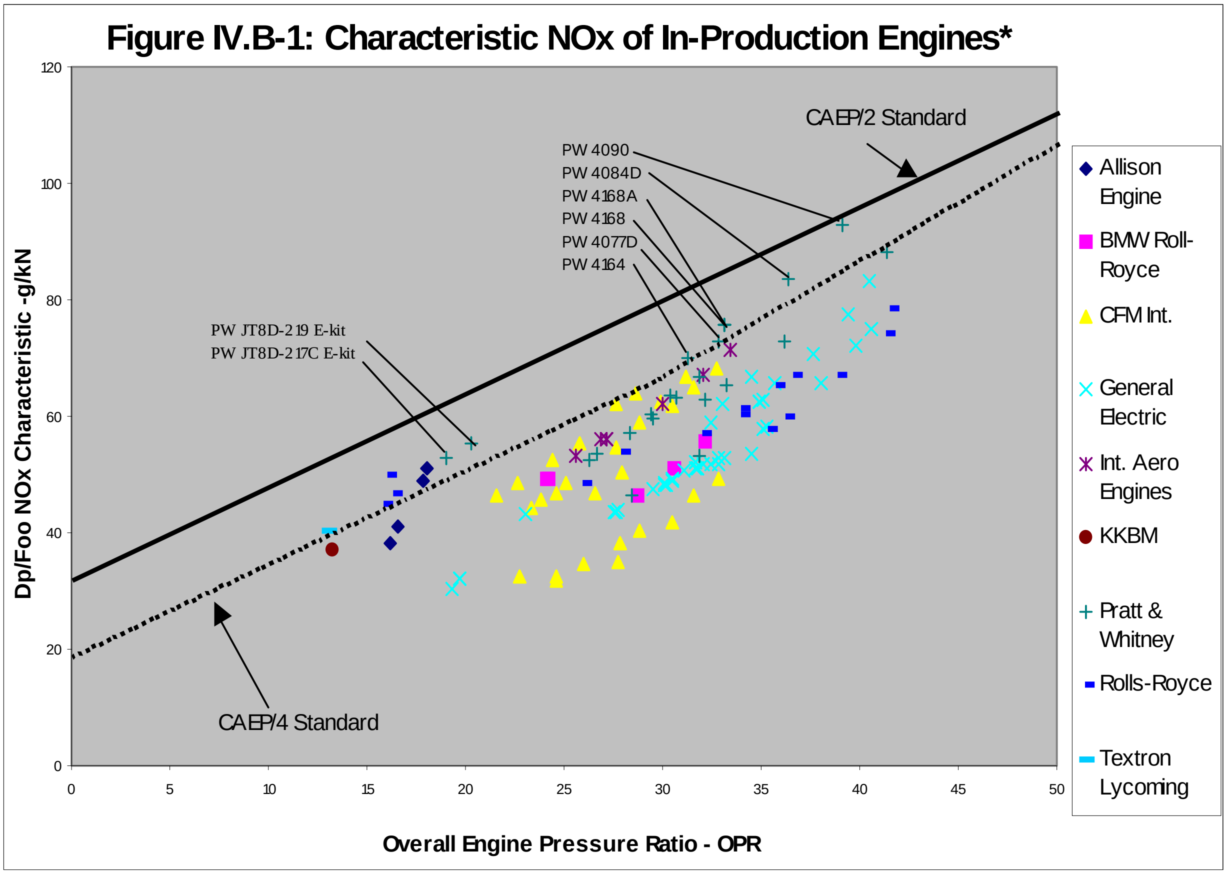
[100] ICAO, CAEP/4, Working Paper 4, "Economic Assessment of the EPG NO_x Stringency Proposal," March 12, 1998, Presented by the Chairman of Forecasting and Economic Analysis Support Group (FESG), Agenda Item 1: Review of proposals relating to NO_x emissions, including the amendment of Annex 16, Volume II, See Table 3.1 of paper. A copy of this paper can be found in Docket OAR-2002-0030.

[101]CAEP Steering Group Meeting, "FESG Economic Assessment of Applying a Production Cut-Off To the CAEP/4 NO_x Standard", Presented by the FESG Co-Rapporteurs, Paris, September 10-13, 2002 (CAEP-SG20022-WP/20, September 12, 2002). The remaining already certified engine models are the JT8D-217C, JT8D-219, PW4084D, and PW4090. A copy of this paper can be found in Docket OAR-2002-0030.

additional testing or modifications, been improved to meet the standards or the engines are no longer in-production.[102] (There is only one remaining newly designed engine model – out of the five identified in 1998 – that may be certified after 2003, and thus, it would need to meet the CAEP/4 or proposed standards for newly certified engines, which are effective beginning in 2004.)[103]

[102] Only the first and second engine types of the three PW types described earlier would not meet the CAEP/4 NO_x standards if they were applied to newly manufactured or already certified engines. The PW4077D is a derated version of the PW4084D, and it is essentially considered the same engine. In addition, the PW4077D has a NO_x level that is 0.2 percent greater than the CAEP/4 standards. FESG rounded this margin to zero and considered the PW4077D to be meeting the NO_x levels of the CAEP/4 standards. The third engine type – PW4164, PW4168 and PW4168A engines -- are now certified with the PW 4168 Technologically Affordable Low NO_x (Talon) II engine combustor technology, which performs significantly better than the CAEP/4 standards.

[103] The PW Canada growth engine is the one remaining newly designed engine model. The ICAO Aircraft Engine Exhaust Emissions Data Bank currently does not have emissions certification data for such an engine, and thus, we anticipate that the PW Canada growth engine would still be affected by the proposed standards. Yet, due to the CAEP/4 standards already established, we expect that PW Canada has already planned modifications for this engine or any other newly certified engines to meet today's proposed standards.



*89 out of 124 (72 percent) of the in-production engines have greater than 10 percent margin to the proposed (or CAEP/4) NO_x standards. 56 (45 percent) of the engines have more than 20 percent margin. 18 (15 percent) of the engines have greater than 30 percent margin.

The recent FESG analysis indicates that the environmental benefit (or NO_x emissions reduction) of applying the CAEP/4 NO_x standards to already certified engines, which would only affect these 4 remaining engines, would be very small. As mentioned earlier, the remaining four already certified (or in-production) engines that perform worse than the CAEP/4 or proposed standards are the following Pratt and Whitney (PW) mid- and high-thrust engines: JT8D-217C, JT8D-219, PW4084D, and PW4090. The in-production JT8D-217C and JT8D-219 engines could potentially apply to future supersonic business jets, and the aircraft application for PW4084D and 4090 engines would be the Boeing 777-200s and -300s. Since business jets have a very low utilization (about 100 to 200 annual departures per aircraft), the emission reductions from potential new JT8D-217C and JT8D-219 applications would be very small irregardless of the size of the supersonic business jet market. If the potential JT8D-217C and JT8D-219 supersonic business jets were to capture the entire projected supersonic business jet market (200 to 400 aircraft over a 10 year period or 20 to 40 aircraft per year), the total estimated annual departures would be about 2,000 to 8,000. For the years 2005 and 2010, there are estimated to be from 23 to 27 million departures from the global passenger aircraft fleet (the potential supersonic business jet market could potentially be about .01 to .03 percent of these global fleet departures), so the resulting NO_x emission benefits would be very small.[104] In regard to Boeing 777 aircraft with PW4084D/4090 engines, the incremental departures for such aircraft are projected to be no greater than 0.1 percent per year (up to 25,500 departures in 2010); therefore, the resulting NO_x emissions reductions would also be considered very small. (The FESG assessment also showed that the costs of applying the CAEP/4 standards to already certified engines would be relatively small on an industry wide basis.)[105] Consequently, we would expect there to be minimal environmental benefit to also apply the proposed and CAEP/4 NO_x standards for newly certified

[104]CAEP Steering Group Meeting, "FESG Economic Assessment of Applying a Production Cut-Off To the CAEP/4 NO_x Standard", Presented by the FESG Co-Rapporteurs, Paris, September 10-13, 2002 (CAEP-SG20022-WP/20, September 12, 2002). In particular, see Table 5.1 entitled, "Excerpt from FESG CAEP/5 Traffic and Fleet Mix Forecast." A copy of this paper can be found in Docket OAR-2002-0030.

[105]The costs of applying CAEP/4 standards to already certified engines would impact just one engine manufacturer.

engines to already certified, newly manufactured engines for an effective date after 2003 (the implementation date of today's proposed standards is December 31, 2003).

Also, if an already certified engine design meets the standards that we are proposing today, then it is unlikely that either existing or future engine designs built to that design or type (derivatives or thrust variants with the same build standard) would not meet these standards. When design modifications are made to an existing engine type, then this engine type would likely need to be re-certified. A re-certified engine type would be required to comply with the CAEP/4 and new proposed NO_x standards.

For the remaining 4 engines (or two engine families) being built that do not meet the CAEP/4 standards, Pratt and Whitney has other in-production engine models (potentially derived versions or thrust variants of engines with the same build standard) or replacement/alternative engines that perform better than the proposed NO_x standards and that are also similar in size and aircraft application.[106] For example, the PW 4098 engine would achieve the NO_x levels of the proposed standards, and similar to the PW4090 it is utilized on the Boeing 777-200 and 777-300. Due to the 1998 CAEP/4 NO_x standards, Pratt and Whitney has recently certified and manufactured these other or replacement engines. Also, based upon the CAEP/4 standards, they have already targeted future (after 2003) engine designs for modification so that newly certified or designed engines would meet today's proposed NO_x standards. Therefore, it appears unlikely that a substantial number of the 4 remaining engines would be built or sold in the future, unless they were produced as spare engines (replacement engines for existing aircraft instead of newly

[106]Although the remaining 4 engines (or two engine families) currently being built are expected to still be in production in year 2004, they would not be required to meet the proposed standards.

manufactured aircraft).

1. Effect of Market Forces

In 1998, FESG indicated at CAEP/4 that "...market forces and potential local/regional operating restrictions might encourage the manufactures to modify their existing products, so that they, too, comply with the proposed stringency."[107] These modifications to in-production engines would be considered "voluntary environmental enhancement."[108] Thus, there was significant consideration at CAEP/4 given to the effect that new NO_x standards for newly certified engines would potentially have on in-production or already certified engines. Many parties within CAEP and its working groups consider market forces to have a real and tangible effect on newly manufactured or already certified engines, even though such engines are not required to comply with the new standards. We are unaware of any new local/regional operating restrictions being implemented throughout the world due to the CAEP/4 NO_x standards. However, it seems some market forces from the CAEP/4 newly certified engine standards have affected production engines since there are now only four in-production engine models remaining from 1998 that

[107] ICAO, CAEP/4, Working Paper 4, "Economic Assessment of the EPG NO_x Stringency Proposal," March 12, 1998, Presented by the Chairman of FESG, Agenda Item 1: Review of proposals relating to NO_x emissions, including the amendment of Annex 16, Volume II, section 3.3.2 of the paper. A copy of this paper can be found in Docket OAR-2002-0030.

[108] However, FESG indicated that the "...the development of production engine emissions enhancements would only occur if the market place showed enough interest in the enhancements or if the failure to meet the proposed stringency became a competitive disadvantage." (ICAO, CAEP/4, Working Paper 4, "Economic Assessment of the EPG NO_x Stringency Proposal," March 12, 1998, Presented by the Chairman of FESG, Agenda Item 1: Review of proposals relating to NO_x emissions, including the amendment of Annex 16, Volume II, section 5.6.2 of the paper. A copy of this paper can be found in Docket OAR-2002-0030.

would not meet the CAEP/4 standards. The Agency solicits comment on the effect market forces and potential local/regional operating restrictions might have on manufacturers to modify in-production or already certified engines.

2. Impact of Existing Fleet Aircraft

An element of the emissions proposals made at CAEP/4 was to increase NO_x stringency as far as possible without affecting the existing fleet aircraft asset values, and this was proposed to be achieved by applying the new stringency to new engine designs only (newly certified engines).[109] Two studies on whether the financial value of existing aircraft assets were affected by the CAEP/2 NO_x standards were reviewed for CAEP/4, and the studies did not reveal any correlation between approval of the CAEP/2 emissions standards and aircraft values. Thus, FESG was unable to definitively assess the effect CAEP/4 NO_x standards would have on fleet aircraft values.[110] (The scope of the two studies and their ground rules were set by FESG.) These studies showed that a large number of factors impact aircraft asset values.

3. Request for Comment on Applying the Proposed NO_x standards to Already Certified Engines

[109]ICAO, CAEP, Fourth Meeting, Montreal, Quebec, April 6-8, 1998, Report, Document 9720, CAEP/4. Copies of this document can be obtained from ICAO (www.icao.int).

[110]ICAO, CAEP/4, Working Paper 4, "Economic Assessment of the EPG NO_x Stringency Proposal," March 12, 1998, Presented by the Chairman of FESG, Agenda Item 1: Review of proposals relating to NO_x emissions, including the amendment of Annex 16, Volume II, section 4 of the paper. A copy of this paper can be found in Docket OAR-2002-0030.

As discussed earlier, FESG and CAEP working groups (specifically, Working Group 3 - Emissions Technical Issues Working Group) are currently considering applying the 1998 CAEP/4 NO_x standards to engines built to already certified engine designs. Today, we are requesting comment on whether to apply the proposed NO_x standards, which are equivalent to the CAEP/4 NO_x standards, to already certified engines.[111] Historically, EPA and ICAO have applied aircraft engine emission standards to already certified engines (or newly manufactured engines).[112] Although there is expected to be minimal environmental benefits (as well as relatively small costs) from such a requirement, it would ensure that manufacturers could not indefinitely produce existing engines that do not meet these standards (four such in-production or already certified engines models exist today).[113]

The implementation dates being analyzed by FESG and Working Group 3 for applying CAEP/4 standards to already certified engines are 2, 4, and 6 years after December 31, 2003 (the implementation date for newly certified engines). Based on the results of the complete assessment (which are not yet available), FESG and Working Group 3 are expected to recommend an implementation date for applying the CAEP/4 standards to already certified

[111]Spare engines for existing aircraft would not be covered by such a requirement.

[112]EPA promulgated a HC standard in 1982 that applied to newly manufactured engines beginning in 1984. Also, the original ICAO NO_x, HC, and CO standards approved in 1981 applied to newly manufactured engines starting in 1986. In 1997, EPA adopted this CO standard, which was to be implemented later that same year for newly manufactured engines. In addition, the March 24, 1993 ICAO amendment to tighten the original NO_x standard by 20 percent (CAEP/2 standards), which EPA adopted in 1997, applied to newly certified engines beginning in 1996 and newly manufactured engines in 2000.

[113]Nearly all engines built to already certified engine designs are likely to be in compliance with the proposed NO_x standards.

engines at CAEP/6 in February 2004 (a decision on this date is also expected at CAEP/6).[114] If this requirement and date is accepted at CAEP/6, EPA would plan to propose the new requirement soon thereafter (see section IV.B. above for a discussion of the emission benefit of applying the proposed standards to already certified engines). We request comment on applying standards for already certified engines at a date 2, 4, and 6 years after the implementation date for new designs (2006, 2008, and 2010). Commenters suggesting different dates should specify the date(s) they prefer and, to the extent possible, provide technical and other justification for such suggested dates.

In addition, at this time the mobile sources (including aircraft engines) regulated under the authority of the Clean Air Act (Title II – Emission Standards for Moving Sources) have emission standards for newly manufactured engines or vehicles. However, except for aircraft engines, all current CAA mobile source programs involving new emission standards apply to newly manufactured engines or vehicles based on the certification model year (new standards apply to newly and already certified engines or vehicles in the same year). In these programs, EPA has incorporated emission averaging programs to make a more orderly product phase-in and phase-out (the average emissions within a manufacturer's product line is required to meet the applicable standard, which allows a manufacturer to produce some engine families with emission

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[114]The FESG analysis mentioned earlier (CAEP-SG20022-WP/20, September 12, 2002) addresses the impact of applying the CAEP/4 NO_x standards to already certified engines at 2, 4, and 6 years after the implementation date of the CAEP/4 standards for newly certified engines. Yet, further assessment of the NO_x emission reductions was requested by the Steering Group for the next meeting in mid-2003. (ICAO, CAEP, Steering Group Meeting, Paris, France, September 10-13, 2002, "Summary of Discussions and Decisions of the First Meeting of the Steering Group," September 10, 2002, CAEP-SG20022-SD/1. See page 3. A copy of this paper can be found in Docket OAR-2002-0030.

levels above the standard[115]). However, averaging is not part of the ICAO protocol, and it is not clear that it is of any value here since most in-production engines already meet the proposed standards. Nonetheless, we solicit comment on whether an emission averaging program for such engines would be useful.

C. Amendments to Criteria on Calibration and Test Gases for Gaseous Emissions Test and Measurement Procedures

In today's proposed rule, EPA proposes to incorporate by reference ICAO's 1997 amendments to the criteria on calibration and test gases for the test procedures of gaseous emissions (ICAO International Standards and Recommended Practices Environmental Protection, Annex 16, Volume II, "Aircraft Engine Emissions," Second Edition, July 1993; Amendment 3, March 20, 1997, Appendices 3 and 5) in 40 CFR 87.64 . ICAO's amendments, which became effective on March 20, 1997, apply to subsonic (newly certified and newly manufactured or already certified engines) and supersonic gas turbine engines. The proposed technical changes would correct a few inconsistencies between the specifications for carbon dioxide (CO_2) analyzers (Attachment B of Appendices 3 and 5) and the calibration and test gases (Attachment D of Appendices 3 and 5) of gaseous emissions. The test procedure amendments incorporated by reference would be effective 60 days after the publication of the final rule.

For CAEP/3 in 1995, the Russian Federation presented a working paper entitled,

[115]Typically, the calculations used for averaging are based upon an engine families yearly production or sales (among other characteristics - e.g., average power rating of engines families).

“Corrections to Annex 16, Volume II,” that stated the following:[116]

> According to CAEP/2 recommendations, in the list of calibration and test gases (see the table in Attachment of Appendices 3 and 5) “CO_2 in N_2" was replaced with “CO_2 in air" gas. At the same time the following sub-paragraph was newly introduced into Attachment B (Appendices 3 and 5) :
>
> (g) The effect of oxygen (O_2) on the CO_2 analyzer response shall be checked. For a change from 0 percent O_2 to 21 percent O_2 the response of a given CO_2 concentration shall not change by more than 2 per cent of reading. If this limit cannot be met and appropriate correction factor shall be applied.
>
> Since the best way to carry out this checking procedure is to calibrate the analyzer first with CO_2 in nitrogen and then with CO_2 in air, both “CO_2 in N_2" and “CO_2 in air” gases have to be retained in the list. It seems then that “CO in air,” “CO_2 in air,” “NO in N_2" and now “CO_2 in N_2" have to be replaced with “CO in zero air,” “CO_2 in zero air,” “CO_2 in zero nitrogen” and “NO in zero nitrogen” just by analogy with the gaseous mixtures of different hydrocarbons diluted by zero air and listed in the same table.

[116]Russian Federation, “Corrections to Annex 16, Volume II,” Agenda Item 2: Review of reports of working groups relating to engine emissions and the development of recommendations to the Council thereon, Working Paper 19, Presented by A.A. Gorbatko, November 11, 1995 (distributed November 30, 1995), CAEP/3, Montreal, December 5 to 15, 1995. A copy of this paper can be found in Docket OAR-2002-0030.

In addition, at CAEP/3 the United Kingdom then presented a working paper on this same issue.[117] They indicated that CAEP's Working Group 3 (Emissions Working Group) had accepted the above proposals of the Russian Federation paper on correcting inconsistencies in the list of calibration and test gases specified in Annex 16, Volume II, Attachment D to Appendices 3 and 5, and Working Group 3 had recommended that these proposals be presented at CAEP/3. The United Kingdom also recommended the adoption of these Russian Federation proposals – to utilize CO_2 in nitrogen gas mixture to check the effect of oxygen on CO_2 analyzers. In addition, they recommended the specification of all calibration and test gases required for all the gaseous emissions tests required in Annex 16.

At CAEP/3, the CAEP members agreed that the above amendments to the calibration and test gases were justified, and thus, these amendments were then adopted.[118] In today's notice, EPA proposes to incorporate by reference the amendments to the criteria on calibration and test gases for the test procedures of gaseous emissions, because the changes improve the test procedures by correcting inconsistencies and distinguishing between calibration and test gases. The amendments would include the following: (1) listing all calibration gases separately from test gases for HC, CO_2, CO and NO_x analyzers, (2) changing "N_2" to "zero nitrogen" in relation to the test gases for the HC and NO_x analyzers, (3) adding "CO_2 in zero nitrogen" as a test gas for

[117]United Kingdom, "Amendments to Annex 16, Volume II, Attachment D to Appendices 3 and 5 (Calibration and Test Gases)," Agenda Item 2: Review of reports of working groups relating to engine emissions and the development of recommendations to the Council thereon, Working Paper 20, Presented by M.E. Wright, November 14, 1995 (distributed November 30, 1995), CAEP/3, Montreal, December 5 to 15, 1995. A copy of this paper can be found in Docket OAR-2002-0030.

[118]ICAO/CAEP, Report of Third Meeting, Montreal, Quebec, December 5-15, 1995, Document 9675, CAEP/3.

CO_2 analyzer, (4) changing “air” to “zero air” in relation to the test gas for CO and CO_2 analyzers, (5) revising the accuracy to “$\pm$ 1 percent” for the “propane in zero air” test gas of HC analyzer, (6) amending the accuracy to “$\pm$ 1 percent” for the “CO_2 in zero air” test gas of CO_2 analyzer, (7) adding the accuracy “$\pm$ 1 percent” for the “CO_2 in zero nitrogen” test gas of CO_2 analyzer, (8) changing accuracy to “$\pm$ 1 percent” for test gas of CO analyzer, and (9) revising accuracy to “$\pm$ 1 percent” for test gas of NO_x analyzer.

Manufacturers are already voluntarily complying with ICAO's 1997 amendments to the criteria on calibration and test gases for the test procedures of gaseous emissions. Thus, formal adoption of these ICAO test procedure amendments would require no new action by manufacturers. In addition, the existence of ICAO's requirements would ensure that the costs of compliance (as well as the air quality impact) with these test procedures would be minimal. (In the 1982 and 1997 final rules on aircraft engine emissions (47 FR 58462, December 30, 1982 and 62 FR 25356, May 8, 1997, respectively), EPA incorporated by reference the then-existing ICAO testing and measurement procedures for aircraft engine emissions (ICAO International Standards and Recommended Practices Environmental Protection, Annex 16, Volume II, “Aircraft Engine Emissions,” First and Second Editions, Appendices 3 and 5 were incorporated by reference in 40 CFR 87.64) in order to eliminate confusion over minor differences in procedures for demonstrating compliance with the U.S. and ICAO standards.)

D. Correction of Exemptions for Very Low Production Models

Because of an editorial error, the section in the aircraft engine emission regulations regarding exemptions for very low production models is incorrectly specified (see section 40 CFR 87.7(b)(1) and (2)). In the October 18, 1984 final rulemaking (49 FR 41000), EPA intended to amend the low production engine provisions of the aircraft regulations by revising paragraph (b) and deleting paragraphs (b)(1) and (b)(2) in order to eliminate the maximum annual production limit of 20 engines per year. In the revisions to paragraph (b), EPA retained the maximum total production limit of 200 units for aircraft models certified after January 1, 1984.[119] For §87.7(b), EPA today proposes to correct this editorial error by eliminating paragraph (b)(1) and (b)(2).

As discussed further in the 1984 final rulemaking, this proposed action would provide more flexibility for engine manufacturers in scheduling during the last few engine production years. Also, the air quality impact of eliminating the annual production limit would be very small.

V. Coordination with FAA

The requirements contained in the notice are being proposed after consultation with the Secretary of Transportation in order to assure appropriate consideration of aircraft safety. Under section 232 of the CAA, the Secretary of Transportation (DOT) has the responsibility to enforce the aircraft emission standards established by EPA under section 231.[120] In addition, section 231(b) of the CAA states that "[a]ny regulation prescribed under this section * * * shall take

[119]This action was taken in 1984 to provide greater flexibility to manufacturers for scheduling engine production rates during the final years.

[120]Specifically, the FAA of the DOT has the responsibility to enforce the aircraft emission standards established by EPA.

effect (after consultation with the Secretary of Transportation) to permit the development and application of the requisite technology, giving appropriate consideration to the cost of compliance * * *." As in past rulemakings and pursuant to the above referenced sections of the CAA, EPA has coordinated with the Federal Aviation Administration (FAA) of the DOT with respect to today's proposal.

Moreover, FAA is the official U.S. delegate to ICAO. FAA agreed to the 1997 and 1999 amendments at ICAO's Third and Fourth Meetings of the Committee on Aviation Environmental Protection (CAEP 3 and 4) after advisement from EPA.[121] FAA and EPA are both members of the CAEP's Working Group 3 (among others), whose objective was to evaluate emissions technical issues and develop recommendations on such issues for CAEP 3 and 4. After assessing emissions test procedure amendments and new NO_x standards, Working Group 3 made recommendations to CAEP on these elements. These recommendations were then considered at the CAEP 3 and 4 meetings, respectively, prior to their adoption by ICAO in 1997 and 1999.

In addition, as discussed above, FAA would have the responsibility to enforce today's proposed requirements. As a part of its compliance responsibilities, FAA conducts the emission tests or delegates that responsibility to the engine manufacturer, which is then monitored by the FAA. Since the FAA does not have the resources or the funding to test engines themselves, FAA selects engineers at each plant to serve as representatives (called designated engineering representatives (DERs)) for the FAA while the manufacturer performs the test procedures. DERs' responsibilities include evaluating the test plan, the test engine, the test equipment, and the final testing report sent to FAA. DERs' responsibilities are determined by the FAA and

[121]The Third Meeting of CAEP (CAEP/3) occurred in Montreal, Quebec from December 5 through 15 in 1995. CAEP/4 took place in Montreal from April 6 through 8, 1998.

today's proposal would not affect their duties.

VI. Possible Future Aviation Emission Reductions (EPA/FAA Voluntary Aviation Emissions Reduction Initiative)

There is growing interest, particularly at the state and local level, in addressing emissions from aircraft and other aviation-related sources. Such interest is often related to plans for airport expansion which is occurring across the country. It is possible that other approaches may provide effective avenues to achieve additional aviation emission reductions, beyond EPA establishing aircraft engine emission standards. The Agency invites comment on the potential approach for additional reductions discussed below and any other approaches.

Concerns by state and local air agencies and environmental and public health organizations about aviation emissions, led to EPA and FAA signing a memorandum of understanding (MOU) in March 1998 agreeing to work to identify efforts that could reduce aviation emissions.[122] Since that time FAA and EPA have jointly chaired a national stakeholder initiative whose goal is to develop a voluntary program to reduce pollutants from aircraft and other aviation sources that contribute to local and regional air pollution in the United States. The major stakeholders participating in this initiative include representatives of the aviation industry (passenger and cargo airlines and engine manufacturers), airports, state and local air pollution

[122]FAA and EPA, "Agreement Between Federal Aviation Administration and Environmental Protection Agency Regarding Environmental Matters Relation to Aviation," signed on March 24, 1998 by FAA's Acting Assistant Administrator for Policy, Planning, and International Aviation, Louise Maillet, and EPA's Acting Assistant Administrator for Air and Radiation, Richard Wilson. A copy of this document can be found in Docket OAR-2002-0030.

control officials, environmental organizations, and NASA.

Initially, the discussions with stakeholders focused on the prospect of aircraft engine emission reduction retrofit kits, which might be applied to certain existing aircraft engines.[123] However, as the initiative evolved, the focus was expanded by the stakeholders to identify strategies for various types of ground service equipment (GSE) in use at airports (e.g., baggage tugs and fuel trucks),[124] in addition to strategies to reduce aircraft emissions.[125] Due to the differences in time and technology that it takes to reduce aircraft emissions versus that for GSE, the stakeholders are seeking to reach a consensus on a distinctly two-step program to voluntarily achieve wide-scale emissions reductions from GSE and aircraft. Near term efforts will focus on emissions reductions from GSE, and long term efforts will focus on reductions from aircraft.[126]

The stakeholders are currently discussing a framework for reaching consensus on the goals or targets for emissions reductions, timing, accountability, State Implementation Plan implications (including general conformity), and numerous other issues that have been raised for GSE and aircraft emission reductions. If this initiative is successful, an agreement would be reached among all the stakeholders on a national voluntary aviation emissions reduction

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[123]Two engine models were indeed certificated with emissions retrofit kits, and a number of these engines have been purchased for aircraft with the retrofit kits installed in their stock configuration. However, retrofit kits have not to date provided widescale emissions improvements because it seems they may have limited applicability to certain engine types, small emission benefits, and cost issues.

[124]The stakeholders are now considering the impact, operation and design of GSE at airports, with projects being undertaken at several airports to reduce overall emissions.

[125]Operational strategies, such as reducing the time in which aircraft are in idle and taxi modes and the impact of auxiliary power units (APUs) have also been considered.

[126]The stakeholder program for aircraft emissions reductions is viewed as a supplement to the traditional regulatory approach of establishing engine emission standards.

program. The mechanism that could be used to codify or enforce an eventual agreement has yet to be determined. The overall goal of the EPA/FAA voluntary initiative is to develop a program that will achieve significant national emission reductions.

VII. Regulatory Impacts

Aircraft engines are international commodities, and thus, they are designed to meet international standards. Today's proposal would have the benefit of establishing consistency between U.S. and international emission standards and test procedures. Thus, an emission certification test which meets U.S. requirements would also be applicable to all ICAO requirements. Engine manufacturers are already developing improved technology in response to the ICAO standards that match the standards proposed here, and EPA does not believe that the costs incurred by the aircraft industry as a result of the existing ICAO standards should be attributed to today's proposed regulations (as discussed above, these standards only apply to newly certified or designed engines, but not already certified, newly manufactured or in-production engines). Also, the test procedure amendments (revisions to criteria on calibration and test gases) necessary to determine compliance are already being adhered to by manufacturers during current engine certification tests. Therefore, EPA believes that the proposed regulations would impose no additional burden on manufacturers.

The existence of ICAO's requirements results in minimal cost as well as air quality benefits from today's proposed requirements.[127] Since aircraft and aircraft engines are

[127]CAEP's Forecasting and Economic Analysis Support Group (FESG) concluded at CAEP/4 that their assessment of these new NO_x standards indicates that the direct costs of the

international commodities, there is significant commercial benefit to consistency between U.S. and international emission standards and control program requirements. Also, EPA's proposed adoption of the ICAO standards and related test procedures would be consistent with our treaty obligations and strengthen the U.S. position in future ICAO/CAEP processes related to emission standards.

VIII. Public Participation

We request comment on all aspects of this proposal. This section describes how you can participate in this process.

A. How Do I Submit Comments?

We are opening a formal comment period by publishing this document. We will accept comments during the period indicated under **DATES** above. If you have an interest in the proposed emission control program described in this document, we encourage you to comment on any aspect of this rulemaking. We also request comment on specific topics identified throughout this proposal.

Your comments will be most useful if you include appropriate and detailed supporting

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standards would be minimal, and the benefits would be modest. (ICAO, CAEP/4, Working Paper 4, "Economic Assessment of the EPG NO_x Stringency Proposal," March 12, 1998, Presented by the Chairman of FESG, Agenda Item 1: Review of proposals relating to NO_x emissions, including the amendment of Annex 16, Volume II.. A copy of this paper can be found in Docket OAR-2002-0030.

rationale, data, and analysis. Commenters are especially encouraged to provide specific suggestions for any changes to any aspect of the regulations that they believe need to be modified or improved. You should send all comments, except those containing proprietary information, to our Air Docket (see section I.C under **SUPPLEMENTARY INFORMATION**) before the end of the comment period.

If you submit proprietary information for our consideration, you should clearly separate it from other comments by labeling it "Confidential Business Information." You should also send it directly to the contact person listed under **FOR FURTHER INFORMATION CONTACT** instead of to the public docket. This will help ensure that no one inadvertently places proprietary information in the docket. If you want us to use your confidential information as part of the basis for the final rule, you should send a nonconfidential version of the document summarizing the key data or information. We will disclose information covered by a claim of confidentiality only through the application of procedures described in 40 CFR part 2. If you don't identify information as confidential when we receive it, we may make it available to the public without notifying you.

B. Will There Be a Public Hearing?

We will hold a public hearing on November 13, 2003 at the Environmental Protection Agency, EPA East Building, Room Number 1153, 1201 Constitution Avenue, N.W., Washington, DC 20004, Telephone: (202) 564-1682. The hearing will start at **10:00 a.m.** local time and continue until everyone has had a chance to speak.

If you would like to present testimony at the public hearing, we ask that you notify the contact person listed under **FOR FURTHER INFORMATION CONTACT** at least ten days before the hearing. You should estimate the time you will need for your presentation and identify any needed audio/visual equipment. We suggest that you bring copies of your statement or other material for the EPA panel and the audience. It would also be helpful if you send us a copy of your statement or other materials before the hearing.

We will make a tentative schedule for the order of testimony based on the notifications we receive. This schedule will be available on the morning of the hearing. In addition, we will reserve a block of time for anyone else in the audience who wants to give testimony.

We will conduct the hearing informally, and technical rules of evidence won't apply. We will arrange for a written transcript of the hearing and keep the official record of the hearing open for 30 days to allow you to submit supplementary information. You may make arrangements for copies of the transcript directly with the court reporter.

IX. Statutory Authority

The statutory authority for today's proposal is provided by sections 231 and 301(a) of the Clean Air Act, as amended, 42 U.S.C. 7571 and 7601. See section III of today's NPRM for discussion of how EPA meets the CAA's statutory requirements.

X. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether this regulatory action is ``significant'' and therefore subject to Office of Management and Budget (OMB) review and the requirements of the Executive Order. The order defines "significant regulatory action" as one that is likely to result in a rule that may:

(1) Have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

EPA has determined that this rule is not a "significant regulatory action" under the terms of Executive Order 12866 and is therefore not subject to OMB review. Today's action would codify emission standards that manufacturers currently adhere to (nearly all in-production engines already meet the standards). The proposed standards are equivalent to the ICAO international consensus standards. These proposed standards would not impose any additional burden on manufacturers because they are already designing new engines to meet the ICAO standards. Thus, the annual effect on the economy of today's proposed standards would be minimal, and none of the other thresholds identified in the executive order would be triggered by this action.

B. Paperwork Reduction Act

This action does not impose any information collection burden under provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. Any reporting and recordkeeping requirements associated with these standards would be defined by the Secretary of Transportation in enforcement regulations issued later under the provisions of section 232 of the Clean Air Act. Since most if not all manufacturers already measure NO_x and report the results to the FAA, any additional reporting and record keeping requirements associated with FAA enforcement of these proposed regulations would likely be very small.

Burden means the total time, effort, or financial resources expended by persons to generate, maintain, retain, or disclose or provide information to or for a Federal agency. This includes the time needed to review instructions; develop, acquire, install, and utilize technology and systems for the purposes of collecting, validating, and verifying information, processing and maintaining information, and disclosing and providing information; adjust the existing ways to comply with any previously applicable instructions and requirements; train personnel to be able to respond to a collection of information; search data sources; complete and review the collection of information; and transmit or otherwise disclose the information.

An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR part 9.

C. Regulatory Flexibility Act

The RFA generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities, small entity is defined as: (1) A small business that meet the definition for business based on SBA size standards; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; or (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field. The following table 1 provides an overview of the primary SBA small business categories potentially affected by this proposed regulation.

Table X.C-1 – Primary SBA Small Business Categories Potentially Affected by This Proposed Regulation

Industry	NAICS[a] Codes	Defined by SBA as a small business if:[b]
Manufacturers of new aircraft engines	336412	< 1,000 employees

Manufacturers of new aircraft	336411	< 1,500 employees
Scheduled air carriers, passenger and freight	481	< 1,500 employees

[a] North American Industry Classification System (NAICS)

[b] According to SBA's regulations (13 CFR part 121), businesses with no more than the listed number of employees or dollars in annual receipts are considered "small entities" for purposes of a regulatory flexibility analysis.

After considering the economic impacts of today's proposed rule on small entities, I certify that this action will not have a significant economic impact on a substantial number of small entities. This proposed rule will not impose any requirements on small entities. Because of the limited classes of aircraft engines to which today's proposed regulations apply, no small entities would be affected. Our review of the list of manufacturers of commercial aircraft gas turbine engines with rated thrust greater than 26.7 kN indicates that there are no U.S. manufacturers of these engines that qualify as small businesses. We are unaware of any foreign manufacturers with a U.S.-based facility that would qualify as a small business. In addition, the proposed rule will not impose significant economic impacts on engine manufacturers. As discussed earlier, today's action would codify emission standards that manufacturers currently adhere to (nearly all in-production engines already meet the standards). The proposed standards are equivalent to the ICAO international consensus standards. These proposed standards would not impose any additional burden on manufacturers because they are already designing new engines to meet the ICAO standards. Also, the test procedure amendments (revisions to criteria on calibration and test gases) necessary to determine compliance are already being adhered to by manufacturers during current engine certification tests. Therefore, EPA believes that the proposed regulations would impose no additional burden on manufacturers. The existence of ICAO's requirements results in minimal cost from today's proposed requirements. We invite comments on all aspects of the proposal and its impacts on small entities.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), Public Law 104-4, establishes requirements for Federal agencies to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. Under section 202 of the UMRA, EPA generally must prepare a written statement, including a cost-benefit analysis, for proposed and final rules with “Federal mandates” that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year. Before promulgating an EPA rule for which a written statement is needed, section 205 of the UMRA generally requires EPA to identify and consider a reasonable number of regulatory alternatives and adopt the least costly, most cost-effective or least burdensome alternative that achieves the objectives of the rule. The provisions of section 205 do not apply when they are inconsistent with applicable law. Moreover, section 205 allows EPA to adopt an alternative other than the least costly, most cost-effective or least burdensome alternative if the Administrator publishes with the final rule an explanation why that alternative was not adopted. Before EPA establishes any regulatory requirements that may significantly or uniquely affect small governments, including tribal governments, it must have developed under section 203 of the UMRA a small government agency plan. The plan must provide for notifying potentially affected small governments, enabling officials of affected small governments to have meaningful and timely input in the development of EPA regulatory proposals with significant Federal intergovernmental mandates, and informing, educating, and advising small governments on compliance with the regulatory requirements.

EPA has determined that this rule does not contain a Federal mandate that may result in expenditure of $100 million or more for State, local, or tribal governments, in the aggregate or the private sector in any one year. This rule contains no regulatory requirements that might significantly or uniquely affect small governments. Today's action would codify emission standards that manufacturers currently adhere to (nearly all in-production engines already meet the standards). The proposed standards are equivalent to the ICAO international consensus standards. These proposed standards would not impose any additional burden on manufacturers because they are already designing new engines to meet the ICAO standards. Thus, the annual effect on the economy of today's proposed standards will be minimal. Thus, today's rule is not subject to the requirements of sections 202 and 205 of the UMRA.

E. Executive Order 13132: Federalism

Executive Order 13132, entitled "Federalism" (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure "meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" is defined in the Executive Order to include regulations that have “substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government.”

This proposed rule does not have federalism implications. It will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government, as specified in Executive Order 13132. As discussed earlier, section 233 of the CAA preempts states from adopting or enforcing aircraft engine emission standards. This proposed rule merely modifies existing EPA aircraft engine emission standards and test procedures and therefore will merely continue an existing preemption of State and local law. Thus, Executive Order 13132 does not apply to this rule.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this proposed rule from State and local officials.

F. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

Executive Order 13175, entitled “Consultation and Coordination with Indian Tribal Governments” (65 FR 67249, November 6, 2000), requires EPA to develop an accountable process to ensure “meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications.”

This proposed rule does not have tribal implications as specified in Executive Order

13175. The proposed emission standards and other related requirements for private industry in this rule have national applicability and therefore do not uniquely affect the communities of Indian Tribal Governments. As discussed earlier, section 233 of the CAA preempts states from adopting or enforcing aircraft engine emission standards. This proposed rule merely modifies existing EPA aircraft engine emission standards and test procedures and therefore will merely continue an existing preemption of State and local law. In addition, this rule will be implemented at the Federal level and impose compliance obligations only on engine manufacturers. Thus, Executive Order 13175 does not apply to this rule. EPA specifically solicits additional comment on this proposed rule from tribal officials.

G. Executive Order 13045: Protection of Children from Environmental Health & Safety Risks

Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks" (62 FR 19885, April 23, 1997) applies to any rule that (1) is determined to be "economically significant" as defined under Executive Order 12866, and (2) concerns an environmental health or safety risk that EPA has reason to believe may have a disproportionate effect on children. If the regulatory action meets both criteria, Section 5-501 of the Order directs the Agency to evaluate the environmental health or safety effects of the planned rule on children, and explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency.

This proposal is not subject to Executive Order 13045 because it is not economically significant under the terms of Executive Order 12866, and because the Agency does not have reason to believe the environmental health or safety risks addressed by this action present a disproportionate risk to children.

The effects of ozone and PM on children's health were addressed in detail in EPA's rulemaking to establish NAAQS for these pollutants, and EPA is not revisiting those issues here. EPA believes, however, that the emission reductions (NO_x and secondary PM) from this rulemaking will further reduce ozone and PM and the related adverse impacts on children's health.

The public is invited to submit or identify peer-reviewed studies and data, of which the agency may not be aware, that assessed results of early life exposure to ozone and PM.

H. Executive Order 13211: Actions that Significantly Affect Energy Supply, Distribution, or Use

This rule is not subject to Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use" (66 FR 28355, May 22, 2001) because it is not a significant regulatory action under Executive Order 12866.

I. National Technology Transfer Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 ("NTTAA"), Public Law 104-113, section 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rulemaking involves technical standards for testing emissions for commercial aircraft gas turbine engines. EPA proposes to use test procedures contained in ICAO International Standards and Recommended Practices Environmental Protection, with the proposed modifications contained in this rulemaking.[128] These procedures are currently used by all manufacturers of commercial aircraft gas turbine engines (with thrust greater than 26.7 kN) to demonstrate compliance with ICAO emissions standards.

EPA welcomes comments on this aspect of the proposed rulemaking and, specifically, invites the public to identify potentially-applicable voluntary consensus standards and to explain why such standards should be used in this regulation.

List of Subjects in 40 CFR Part 87

Environmental protection, Air pollution control, Aircraft, Incorporation by reference.

Dated: ___________

ORIGINAL SIGNED BY MARIANNE LAMONT HORINKO, SEPTEMBER 12, 2003

Marianne Lamont Horinko, Acting Administrator

[128] ICAO International Standards and Recommended Practices Environmental Protection, Annex 16, Volume II, "Aircraft Engine Emissions," Second Edition, July 1993 -- Amendment 3, March 20, 1997. Copies of this document can be obtained from ICAO (www.icao.int).

For the reasons set out in the preamble, title 40, chapter I of the Code of Federal Regulations is proposed to be amended as follows:

PART 87 -- CONTROL OF AIR POLLUTION FROM AIRCRAFT AND AIRCRAFT ENGINES

1. The authority citation for part 87 continues to read as follows:

Authority: Secs. 231, 301(a), Clean Air Act, as amended (42 U.S.C 7571, 7601(a)).

Subpart A–[Amended]

2. Section 87.7 is amended by removing paragraphs (b)(1) and (b)(2).

Subpart C–[Amended]

3. Section 87.21 is amended by adding paragraph (d)(1)(vi) to read as follows:

§87.21 Standards for exhaust emissions.

*   *   *   *   *

(d)   *   *   *

(1)   *   *   *

(vi) Engines of a type or model of which the date of manufacture of the first individual production model was after December 31, 2003:

(A) Engines with a rated pressure ratio of 30 or less:

(*1*) Engines with a maximum rated output greater than 89 kilonewtons:

Oxides of Nitrogen: (19 + 1.6(rPR)) grams/kilonewtons rO.

(*2*) Engines with a maximum rated output greater than 26.7 kilonewtons but not greater than 89 kilonewtons:

Oxides of Nitrogen: (37.572 + 1.6(rPR) - 0.2087(rO)) grams/kilonewtons rO.

(B) Engines with a rated pressure ratio greater than 30 but less than 62.5:

(*1*) Engines with a maximum rated output greater than 89 kilonewtons:

Oxides of Nitrogen: (7 + 2(rPR)) grams/kilonewtons rO.

(*2*) Engines with a maximum rated output greater than 26.7 kilonewtons but not greater than 89 kilonewtons:

Oxides of Nitrogen: (42.71 + 1.4286(rPR) - 0.4013(rO) + 0.00642(rPR × rO)) grams/kilonewtons rO.

(C) Engines with a rated pressure ratio of 62.5 or more:

Oxides of Nitrogen: (32 + 1.6(rPR)) grams/kilonewtons rO.

* * * * *

Subpart G–[Amended]

4. Section 87.64 is revised to read as follows:

§87.64 Sampling and analytical procedures for measuring gaseous exhaust emissions.

The system and procedures for sampling and measurement of gaseous emissions shall be as specified by Appendices 3 and 5 to International Civil Aviation Organization (ICAO) Annex 16, Environmental Protection, Volume II, Aircraft Engine Emissions, Second Edition, July 1993 (including Amendment 3 of March 20, 1997), which are incorporated herein by reference. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. These materials are incorporated as they exist on the date of the approval and a notice of any change in these materials will be published in the **Federal Register.** Frequent changes are not anticipated. Copies may be inspected at U.S. EPA, Air and Radiation Docket and Information Center, 1301 Constitution Ave., NW, Room B102, EPA West Building, Washington, DC 20460, or at the Office of Federal Register, 800 North Capitol Street, NW., 7th Floor, Suite 700, Washington DC. Copies of this document can be obtained from the International Civil Aviation Organization (ICAO), Document Sales Unit, 999 University Street, Montreal, Quebec, Canada H3C 5H7.

5. Section 87.71 is revised to read as follows:

§87.71 Compliance with gaseous emission standards.

Compliance with each gaseous emission standard by an aircraft engine shall be determined by comparing the pollutant level in grams/kilonewton/thrust/cycle or grams/kilowatt/cycle as calculated in §87.64 with the applicable emission standard under this part. An acceptable alternative to testing every engine is described in Appendix 6 to

International Civil Aviation Organization (ICAO) Annex 16, Environmental Protection, Volume II, Aircraft Engine Emissions, Second Edition, July 1993 (including Amendment 3 of March 20, 1997), which is incorporated herein by reference. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. These materials are incorporated as they exist on the date of the approval and a notice of any change in these materials will be published in the **Federal Register.** Frequent changes are not anticipated. Copies may be inspected at U.S. EPA, Air and Radiation Docket and Information Center, 1301 Constitution Ave., NW, Room B102, EPA West Building, Washington, DC 20460, or at the Office of Federal Register, 800 North Capitol Street, NW., 7th Floor, Suite 700, Washington DC. Copies of this document can be obtained from the International Civil Aviation Organization (ICAO), Document Sales Unit, 999 University Street, Montreal, Quebec, Canada H3C 5H7. Other methods of demonstrating compliance may be approved by the Secretary with the concurrence of the Administrator.

6. Section 87.82 is revised to read as follows:

§87.82 Sampling and analytical procedures for measuring smoke exhaust emissions.

The system and procedures for sampling and measurement of smoke emissions shall be as specified by Appendix 2 to International Civil Aviation Organization (ICAO) Annex 16, Volume II, Environmental Protection, Aircraft Engine Emissions, Second Edition, July 1993 (including Amendment 3 of March 20, 1997), which are incorporated herein by reference. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. These materials are incorporated as they exist on the date of the approval and a notice of any change in these materials will be published in the **Federal Register.** Frequent changes are not anticipated. Copies may be inspected at U.S. EPA, Air and Radiation Docket and Information Center, 1301 Constitution Ave., NW, Room B102, EPA West Building, Washington, DC 20460, or at the Office of Federal Register, 800 North Capitol Street, NW., 7th Floor, Suite 700, Washington DC. Copies of this document can be obtained from the International Civil Aviation Organization (ICAO), Document Sales Unit, 999 University Street, Montreal, Quebec, Canada H3C 5H7.

7. Section 87.89 is revised to read as follows:

§87.89 Compliance with smoke emission standards.

Compliance with each smoke emission standard shall be determined by comparing the plot of SN as a function of power setting with the applicable emission standard under this part. The SN at every power setting must be such that there is a high degree of confidence that the standard will not be exceeded by any engine of the model being tested. An acceptable alternative to testing every engine is described in Appendix 6 to International Civil Aviation Organization (ICAO) Annex 16, Environmental Protection, Volume II, Aircraft Engine Emissions, Second Edition, July 1993 (including Amendment 3 of March 20, 1997), which is incorporated herein by reference. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. These materials are incorporated as they exist on the date of the approval and a notice of any change in these materials will be published in the **Federal Register.** Frequent changes are not anticipated. Copies may be inspected at U.S. EPA, Air and Radiation Docket and Information Center, 1301 Constitution Ave., NW, Room B102, EPA West Building, Washington, DC 20460, or at the Office of Federal Register, 800 North Capitol Street, NW., 7th Floor, Suite 700, Washington DC. Copies of this document can be obtained from the International Civil Aviation Organization (ICAO), Document Sales Unit, 999 University Street, Montreal, Quebec, Canada H3C 5H7.